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Safety First—Within Reason.

TO get an idea hammered into its consciousness and then to be obsessed by it is, we believe, a characteristic of our race; it may be seen repeatedly in our political history, not always operating to our advantage. Doubtless it enabled us to hold out through the Great War; equally in times of peace it often determines our conduct, and it may lead us beyond due bounds if not controlled by the light of reason.

To class the slogan "Safety First" as liable to become an obsession may expose us to criticism as lacking in humanity; but is it not possible to sacrifice too much for the sake of a merely hypothetical return? By all means let all reasonable precautions be adopted to ensure the safety of the citizen—it is only when the safeguards become to our mind unreasonable that we feel bound to utter a protest, in the interests of the public as a whole. A case in point was the statute which stipulated that vehicles propelled by mechanical power should be preceded by a man on foot, bearing a red flag, and should not travel at a higher speed than four miles an hour. But for that regulation British engineers, who invented steam-driven road cars over a century ago, might have led the world in the development of the automobile—but it was not relaxed until Parliament was compelled in 1896 to permit motor-cars to travel (at 12 miles an hour!) on ordinary highways. That is a typical example of precaution carried to the limit, as a result of which it took us years to catch up the rest of the world in the manufacture of automobiles.

These thoughts were prompted by a recent visit to an English village remote from civilisation, which has been supplied with electricity for many years by a small plant which, if old and apparently inadequate,

nevertheless fulfils its purpose quite well. The proprietors do not seem to have heard of the Board of Trade (or *vice versa*) or of the Electricity Commissioners, for some of the overhead wiring—in particular, the tapping of services—conforms to no rules whatever; even for bell wiring it would hardly pass inspection. Yet *it works*, and so far as we could ascertain, it works well; and the pressure is 200 volts.

Last year we made a tour of the rural distribution system installed by Mr. S. E. Britton in the neighbourhood of Chester, which has been carried out on first-class lines, presenting a striking contrast with the system mentioned above. Being a statutory undertaking, and in the public eye, it has complied with every regulation laid down by the successors of the Board of Trade for ensuring the safety of the public, at a cost which renders it almost impossible to supply electricity for lighting at a profit; consequently the Chester Corporation of necessity must do its utmost to develop a demand for cooking and heating, and other uses of electricity. That is all to the good—but it should not be a necessity, for undoubtedly electricity can be supplied for lighting by simple and inexpensive means which bring it within the reach of the poorest consumer, and yet involve no appreciable risk to the passer-by.

We advocate neither of the extremes that we have cited. That there is a middle course we are convinced, having had occasion to visit other British rural distribution systems which are entirely adequate to their purpose but, without involving any perceptible danger to the public, have been constructed on economical lines. The regulations for overhead conductors laid down by the Electricity Commissioners are in some respects more stringent than, in our opinion, is warranted by the circumstances, at any rate in the case of rural distribution; but whilst the highest standards are defined in the official regulations, it by no means follows that they will be rigidly enforced, or that their stringency cannot be mitigated by the adoption of suitable methods subject to the approval of the Commissioners. So long as hundreds of miles of 500-volt trolley wires are suspended above crowded streets, constantly in a state of vibration and subject to wear, and sometimes dependent on solder for support—and yet do not give rise to frequent accidents, it cannot reasonably be argued that overhead lines of simple construction and exposed to far less arduous conditions are liable to become "death-traps." Not only reason, but experience—here and abroad—tells us that there is no appreciable risk from overhead wires at 200 volts, and that unduly high standards of construction involve an outlay out of all proportion to the slight and problematic benefits that they confer.

We have, on previous occasions, expressed similar views with regard to the "Regulations for the electrical equipment of buildings" issued by the Institution of Electrical Engineers, and we observe that, in the report of the I.E.E. Committee on Electricity in Agriculture, which is published in the current issue of the *Journal*, the Committee suggests "that the Institution should take steps to propose rules for rural distribution networks, overhead and underground. These Rules only to apply to distribution to farms, villages, and small industries, leaving other work to be carried out under the existing Regulations as at present approved by the Electricity Commissioners." We earnestly hope that if this suggestion is adopted, the result will not be to plant further obstacles in the way of the use of electricity in rural areas. The difficulties are already sufficiently numerous without our taking steps to add to their number.

The Place of Woman in Salesmanship.

In the course of a recent speech, Sir Alfred Mond said that the antiquated methods of our salesmanship needed revision. He was discussing the many problems which face us to-day as an industrial people with a vast army of unemployed, and the remark quoted was made in considering the needs of the future with respect to organisation and administration. Every day in the newspapers the advice is given to the rising generation who wish to succeed in these difficult times, when men's jobs are so scarce and applicants for them are so numerous, that they should take a course of salesmanship. Some naturally are foredoomed to disappointment, but if we can raise the standard of business-getting efficiency it will be advantageous to this nation of shopkeepers.

Training for salesmanship is not a closed preserve for mere men nowadays; the door is open wide for the woman of business capacity. It has long been so in retail shopkeeping, and in certain departments of wholesale trade, and wonderfully successful have some women been. We in the electrical trade can recognise too that woman has an important place to fill in securing the full rate of advance in electrical development, especially in the domestic field. The more readily and generously we recognise this fact and allow the members of the fair sex to exercise their powers of conviction and persuasion to the full, the better it will be for the whole electrical industry. What is more obvious than the disposition of the mistress or housewife to admit one of her own sex into the sanctities of the household, to talk pleasantly over the uses of electricity in domestic life and the various points requiring elucidation or demonstration in connection with installed apparatus? Where a male canvasser meets with a chilling reception, or is peeped at through a door nervously opened but half-a-dozen inches, one of the opposite sex is given a cordial welcome and is invited to call again and continue the subject. Borough electrical engineers and committees, and above all boards of directors, ought to consider this aspect of local domestic electrical development far more seriously than they have done.

Of course, it is not suggested that any and every female is fitted for such a vocation. There are many qualities and qualifications required of the perfect woman in salesmanship, but happily women are devoting close and organised attention to this matter, as witness the inclusion of the subject in the programme of the Conference of Women in Science, Industry, and Commerce held in July. One of the papers contained many points of interest to those who believe, as does the author of the paper (Miss Gladys Burton, B.A.), that "selling is an occupation which is fast being raised to the rank of a profession," that "selling offers a career of absorbing interest to girls of the right temperament," and that "for the successful saleswoman there is always a market." We agree that while a "delightful personality" is not wasted anywhere, it is of first importance in selling, and we may add that in electrical salesmanship it should be particularly welcome. With a delicate womanly touch, Miss Burton said that the only law of salesmanship was "to love one's customer as oneself" (assuming, of course, we suppose, that the said customer was not too masculine), by which we judge her to lay stress upon the importance of having a satisfied consumer, by giving lasting satisfaction and avoiding the opportunity of taking temporary advantage.

Knowledge of the stock handled, some particulars of its production, its operation, its good qualities, and the performance it can render, are of course essentials, both in a man and in a woman, particularly when endeavouring to convince, win, and satisfy electrical consumers. The saleswoman must even more be able to "understand the men and women with whom she is daily confronted," though a diverting tilt is made by the author at the professors of psychology who "find ordinary tact quite beyond them" . . . . "I suppose because one cannot understand people unless one loves them." We find it difficult as mere men to tell male canvassers that in order to understand their prospective customers they must give definite evidence of affection

for them—it might at times land them in awkward situations—but there is no disputing the truth of the more common rendering that we may use, namely, that the canvasser who is acquainted with the needs and difficulties of the consumer, and seriously and good-humouredly tries to meet those needs and overcome those difficulties, is showing a regard for the said consumer and for his employers' interests at the same time. "Salesmanship" is, after all, "the ability to sell goods that won't come back to customers who will." Of course, there is a very human and practical side to all this, as some supply employés, wearied with fruitless calls, irritated beyond endurance by the petty annoyances to which they are subjected, and conscious of their own and other people's limitations, will be feeling as they read these lines. We are not out to secure the supersession of our own sex at a time when so many good men are out of employment, but we feel that the position of woman on the commercial side of the electrical supply industry calls for more exploration than it has yet had, and that there is plenty of room for the profitable employment of electrical business-getting women in many localities without dispensing with the services of any present male employé.

Electrical Accidents in Mines.

THE report of H.M. Electrical Inspector of Mines for 1924, which is abstracted elsewhere in this issue, reveals the regrettable fact that during the year there were 18 deaths attributable to the use of electricity in coal mines, of which 13 were due to electric shock; this is a bad showing compared with previous years—the worst since 1913, when the same number of deaths due to shock below ground was recorded. The average for the five years previous to 1924 was happily only five, and for the ten years 1914-1923 it was 4.9. It is to be hoped that the serious increase last year will prove to be exceptional, and that future records will be at minimum values.

Most of the fatalities due to electric shock occur in connection with the operation of coal-cutting machines, and frequently they are due to some defect in the earthing conductor or its connections. The Inspector considers that there is room for radical improvement in the existing designs of plug connector, and a perusal of the report certainly supports that view. A standard specification for plugs and sockets is being prepared by the B.E.S.A., and good progress has been made with it. The delay in dealing with this detail, of literally vital importance, has probably been due to the fact that the machines continue to work satisfactorily when the earthing device is inoperative, and as all goes well until a failure of insulation of the live conductors occurs, the first indication that anything is out of order may be a fatal shock. Regular examination and testing of the earthing devices would go far to minimise the risk of accident, but the Inspector points out that in many cases this procedure is not efficiently carried out; as the use of electricity in mines is constantly increasing, the importance of adequate maintenance cannot be over-emphasised, and the work should be entrusted only to fully qualified electrical engineers who thoroughly understand the machinery that is placed in their charge. It is true that a large proportion of the accidents recorded are due to the ignorance, carelessness, or temerity of the men who pay so high a penalty for their rashness, and it is impossible to guard against such occurrences, but at least every care should be taken to make sure that the apparatus employed is not at fault. One class of defect which in the past has been responsible for the loss of many lives is the omission of a set screw, leaving an opening in a casing intended to be flame-proof, and leading to an explosion of gas. Wherever it is possible, studs should be used instead of set screws, or the screw-holes so disposed that the loss of a screw does not necessarily leave a clear channel for flame to pass through.

Standards of Quality.

OUR Canadian correspondent rightly takes us to task for overlooking the constitution and achievements of the Approval Laboratories of the Hydro-Electric Power Commission of Ontario in our recent leader on this subject. The organisation, procedure, and functions of these laboratories were described in some detail in our issue of April 29th, 1921, and they have frequently been referred to in our abstracts of the annual reports of the Commission, including that which appeared in our last issue. We had not, however, appreciated the fact brought out by our correspondent, that the verdict of the Ontario Laboratories was accepted by the electrical industry in the other Provinces of the Dominion, even when the approval of the Underwriters' Laboratories had not been obtained. The matter is of some importance, and we are glad to know that the restrictive influence of the Chicago institution with regard to the sales of British products in the Dominion of Canada is less effective than we imagined.

But still, it must not be supposed that this particular obstacle is not formidable, nor may it be assumed that the Ontario Laboratories offer a wide-open door to British products. We are well aware that the quality of these goods is generally well above the standards set by either of the authorities above-mentioned, and that in most cases they would be accorded the hall-mark of approval without demur; the trouble is that, as we indicated in our leader, there are difficulties of procedure besides that of communication at long range, in the absence of direct representation on the spot, which block the way through the Laboratories to the issue of labels. Years ago an attempt was made to meet the situation by appointing representatives of the Underwriters' Laboratories in London, and for some time Messrs. Heap and Digby fulfilled that office; the arrangements that were made were fully detailed in our pages at the time. But that system was ended, we believe, by the outbreak of the Great War, and whilst there is still a measure of co-operation between the insurance offices in this country and the Underwriters' Laboratories, there is no fully-organised system in operation. We are not aware that the Ontario Laboratories have ever been represented in Britain.

Of the hearty goodwill of both these testing institutions we have no doubt whatever. It was not the fault of the Underwriters' Laboratories that direct representation on this side was abandoned; as recently as 1922 the late president, Mr. W. H. Merrill, was in this country and made arrangements with the Fire Offices Committee in London under which the latter agreed to assist in the conduct of examinations and tests in England, a service which has been utilised upon occasion in connection with Canadian business. We are assured that the Laboratories are willing to do whatever is within their power to meet any demand on the part of British manufacturers who wish to export to Canada or the United States for service similar to that performed for American industries, and the same would apply to the Approval Laboratories of Ontario—but the difficulties, partly technical and partly administrative, are admittedly serious. It has been suggested that the Laboratories should deposit their specifications with a recognised testing institution in this country, such as the National Physical Laboratory, or Faraday House, and accept certificates from that body to the effect that British products which it has tested do—or do not—comply with the specifications; but the best solution, to our mind, would be the establishment of the British Proving-House which was so warmly advocated by the late Mr. C. H. Wordingham, and which, no doubt, would act in close accord with the two transatlantic bodies.

We have in our possession a pamphlet fully describing the organisation and practice of the Underwriters' Laboratories, and the last half-yearly list of electrical appliances inspected, which may be seen by persons interested in this subject.

The "Sila" Hydro-Electric Development Scheme.

A Great Electrical Undertaking in Southern Italy.

By J. S. BARNES.

A DENSE network of electric high-pressure transmission lines now covers almost the whole of Italy, and forms a national system of electrical power supply. Close on 2,000,000 kW is actually installed, producing over 5½ milliards of kW-hours a year, with an average load factor of approximately 45 per cent. The great majority of the installations are hydro-electric, though, as development continues apace, and engineers are driven to consider hydro-electric schemes in new districts less adapted to the construction of large artificial lakes, a

Fig. 1.—Map of Southern Italy and Sicily, showing Electricity Supply Mains, etc.

growing demand for supplementary thermal power stations is now being experienced and is in course of being supplied. Nevertheless, it is mainly her resources in water power that are enabling Italy gradually to become, industrially, a rich country; and no other country in the world offers such a complex and interesting example of the technique of co-ordinating power supply by which various kinds of power installations, dotted all over the peninsula from the Alps to Sicily, are linked up and made to remedy each other's deficiencies.

Naturally, the greatest development has come in the north and, in a second degree, in the centre of Italy, where the presence of large towns and long-established industries provided a ready market and where opportunities for the remunerative employment of capital were much greater than in the poverty-stricken south. Moreover, the more abundant and more evenly distributed rainfall in the north made hydro-electric development less costly. Gradually, however, as the technique of power co-ordination has developed along with the ability to transmit power over long distances without too great an economic loss, the south has begun to be opened up. South of Naples, six large hydro-electric power stations, besides a number of smaller ones, are already working, as well as three in Sicily, and the famous "Tirso" plant in Sardinia, which possesses the largest artificial lake in Europe.

The regeneration of the south of Italy depends very largely on the economical utilisation of water. The vast land, lying between the mountains and the sea, is often devastated by malaria, which is principally caused by the flooding of large areas during short periods of torrential rain, and the subsequent partial drying-up, thus forming ideal breeding ground for the mosquito. The precious water, in this land of long dry summers, is at the same time wasted, being no longer available for the purpose of irrigation at the seasons when it is chiefly needed. The floods, too, cause incalculable damage by erosion. Moreover, the failure up to the present to discover mineral wealth on the main land of Southern Italy, coupled with the above causes which make even the only great local industries, namely, agriculture and afforestation, barely profitable, condemns the people of this beautiful country to an existence of the direst poverty, mitigated only by the fairness of the climate and the remittances of emigrants, who leave to gain their livelihood in other parts of Europe and in America every year to the tune of over 200,000.

Since the unification of Italy, something indeed has been done by the Government, to improve the lot of these districts by the expenditure of public money on the development of the means of communication, on the supply of drinking water, on the provision of quinine and wire netting whereby to combat the malaria, and on the provision of schools. But the efforts of the Government have in the past been unco-ordinated and sporadic. Since 1922, on the other hand, the various measures in the above sense have been speeded up by the Fascist Government and large extra funds provided. Yet, only lately has it come to be realised that the regeneration of the South can only be effected by solving the water question by comprehensive schemes, that is, by utilising the water power resources of the country for the provision of power for industries (especially those industries which either feed or are fed by agriculture); by impounding the water in large artificial lakes, whereby as much as possible of the comparatively small rainfall may be utilised in power production; by thus avoiding, at one and the same stroke, both the erosion and the floods, and at the same time providing water for irrigation either by the impounded waters or by means of electrical pumping; by exterminating malaria at its origins, and by the opening up of richer land to intensive agriculture.

With all these economic objectives can be attained in a single scheme, many projects, otherwise unproductive, can be made to pay; and the Government has learnt that in encouraging and assisting such schemes, public money may be most profitably employed in harmony with individual initiative. Sardinia, the topography of which lends itself peculiarly well to the purpose, is furnishing the most typical example of development on these lines. A plan of development has been drawn up for the whole island. The presence of numerous great artificial lakes, of which two are already in existence, will soon transform the aspect of the country, and within a generation this, the poorest of Italian provinces, promises to become one of the richest.

The problem of Sicily is more difficult, because the topography of the country is not suited to the creation of large artificial lakes. What can be done in this way locally has already been done. The final solution of the problem is awaiting the completion of the great power scheme in course of construction in Calabria, known as the "Sila" project—from the name of the plateau and forest of the Sila situated in the "ball," so to speak, "of the foot of Italy," whence power is to be derived and carried, not only to the neighbouring provinces of Basilicata, Puglia, and Campania (Naples), but also across the Straits of Messina to Sicily.

During a recent visit to Southern Italy I have been given opportunities through the kindness of the chairman of the "Sila" Company, Commendatore Maurizio Capuano, and of the famous engineer, Commendatore Angelo Omodeo, who is the author of the scheme, to visit the works now well under way.

The district is one of the most remarkable in Italy, not only for its natural beauty, but for its wildness and its contrasts with what one usually associates with Southern Italy. The Sila plateau lies between the Ionian and Tyrrhenian Seas, between the Port of Cotrone and the town of Cosenza; it is over 1,000 sq. kilometres in extent and at an altitude of over 4,000 ft. above the level of the sea. It is thickly covered by an immense forest of fir and pine, poplar and beech, and is broken by the ridges of higher mountains rising to 6,000 or 7,000 feet. For four months of the year it is covered with deep snow. The chief river draining it is the Neto, fed by its main tributaries, the Arvo, the Garga, and the Ampollino, which finds its way to the Ionian Sea a few miles north of Cotrone, all at once diving down from the height of the plateau into the low, fertile, but altogether deserted, undulating plain between the sea and the great mountain wall. Geologically the district is formed of ancient impermeable volcanic rock, thus combining with the local topography to present ideal conditions for a hydro-electric scheme requiring large artificial lakes.

The scheme, when completed, will be one of the largest of its kind in Europe, producing over 140,000 continuous kW in four power stations, the largest of which, namely, that of Timpa Grande, will produce over 107,000 continuous h.p., with over 160,000 kW of plant installed.

The accompanying map and diagram, fig. 2, illustrate the scheme, which I will now endeavour to describe in detail. For clearness it will be found convenient to divide the description into three parts, as follows:—

1. The creation of three storage reservoirs by means of three dams on the upper reaches of the Rivers Neto, Garga, and Arvo—the first two having a useful capacity of four million cubic metres each, the third of 157 million cubic metres (approx. 34,540,000,000 gallons). For all intents and purposes they will form one single reservoir, as they will be connected up by pressure tunnels and have a common top water level of 1,287 metres (4,223 ft.) above the sea. By thus impounding the waters of these three rivers, the *régime* of the latter will be completely regulated.

From the Ampollino reservoir an underground flume 3⅓ miles in length will carry the mean discharge of the above lakes into a fourth reservoir, namely, that of the Ampollino, having a useful capacity of 61 million cubic metres (approximately 13,420,000,000 gallons) and a top water level 1,270 metres (4,176 ft.) above sea level. Thence the continuous discharge will be 6.5 cubic metres per second (=approx. 85,800 gallons per minute).

Taking off from the Ampollino dam at a level of 1,250 metres, a tunnel will carry this water under pressure for 4,395 metres to a point immediately above the power station, known as the "Orichella" power station, situated lower down on the River Ampollino, about 800 metres above sea level. At the outlet end of the tunnel will be constructed a surge tower, and a pressure forebay for the pipe line. The mean head will be 467 metres and, as 1 cubic metre of water falling in one second through a vertical height of 1 metre

Fig. 2.—Plan and Vertical Section of the "Sila" Scheme.

is the equivalent of a little more than 13 h.p., we thus arrive at a figure of approximately 40,000 continuous h.p., or approximately 30,000 continuous kW, representing the amount of continuous power to be obtained at this point.

The two big dams to be constructed in connection with this section of the scheme will be those impounding the waters of the Arvo and Ampollino. Both will be of the usual trapezoidal shape and built of masonry. Their respective measurements will be 40 metres (130 ft.) high and 270 metres (900 ft.) long; and 31 metres (102 ft.) high and 138 metres (450 ft.) long. The latter is already on the verge of completion.

2. The creation of two storage reservoirs of 20 million cubic metres capacity on the Neto and of four million cubic metres on the Arvo, approximately ten and eight miles respectively below the upper reservoirs, and having top water levels of 1,150 and 1,070 metres. From the latter the water will be led by tunnel under pressure to the head of the pipe line and surge tower. The water from the first reservoir will be discharged into the pressure tunnel about half way along its course of about 3½ kilometres. The total mean discharge has been calculated at 4 c.m. per second, so that with a mean head of 210 metres, another 11,000 continuous h.p. will be obtained at the second power station of S. Giovanni situated lower down in the valley of the Neto, about 850 metres above sea level. Thence the water will be carried by another tunnel and discharged into the bed of the Ampollino close to the first power station (Orichella).

3. From this point the combined discharges (amounting to 10.5 c. metres per second) will be carried by open flume and tunnel a distance of 3,665 metres to the head

of the third and greatest power station (Timpa Grande). Meanwhile the water available will have been increased to a mean of 15 c.m. per second by the addition of water derived, also by tunnel, from the upper reaches of the River Tacina, which runs parallel to and to the south of the Ampollino. The head being 467 metres, no less than 107,000 continuous h.p. will be generated at this point. Over 160,000 kW of plant will be installed. At the head of the pipe line there will be a penstock (already nearing completion), sufficient to regulate the varying requirements of the daily demand for power. There will be seven pipe lines.

4. Slightly below the discharge of the water from the turbines into the Timpa Grande (which joins the Neto a few hundred yards farther down) there is to be built an intake barrage, from which a second open flume and tunnel will carry the water into a second penstock at the head of the fourth and last of the projected power stations (the Altilia power station), situated on the lower Neto 164 metres below the mean water level of the penstock. Thus the power to be generated there will be a further 32,000 continuous h.p., making a total for the stations of over 190,000 continuous h.p., equal to approximately 140,000 continuous kW.

This will mean, including reserves, the installation of a total of over 300,000 kW of machinery in order to meet an estimated load of 50 per cent. l.f. The discharges of the last two power stations will not be entirely regulated by direct storage; but by disposing of the machinery in the right proportions between the stations and co-ordinating their operation, it will be possible to utilise the whole of the power nominally available. Thus the annual output of energy which will come actually to be sold will total approximately 1,250 million kWh or Board of Trade units.

Three main transmission lines, consisting each of two 3-phase circuits carried on lattice poles of reinforced concrete and steel structure, will start from the Timpa Grande station and will carry the current at the high pressure of 135,000 volts, the first to Taranto for Bari, Brindisi, and Lecca; the second to join up with an existing power station at Tanagro, near Potenza, whence energy is supplied to Naples; the third to Catanzaro and Reggio and across the Straits of Messina in Sicily. A fourth line at a lower voltage will serve Cosenza and Paola, and a fifth Cotrone (see fig. 1).

Only by transporting power over these very considerable distances will it be possible to secure the necessary markets. Naples and the thickly-populated Campania form a market with a continually increasing demand. The same, on a smaller scale, may be said of Taranto, now the chief naval station of Italy, and Bari, which is becoming an increasingly important commercial port and manufacturing centre. Locally it is calculated that, apart from special industries, not more than 25,000 kW will for some time be able to be absorbed. The importance of Sicily, therefore, as a market, with its teeming population, its considerable industries, its sulphur mines, and its need for water by pumping from the subsoil, cannot be overlooked. This, however, necessitates the transport of energy across the Straits of Messina. To this end the United States Steel Corporation has, through the American Bridge Co., of Pittsburg, which is controlled by it, been approached with a view to the construction of an aerial line across the Straits. No contract has as yet been signed, but the following scheme put forward by the American Bridge Co. has been accepted as the best solution:—

Two steel towers are to be constructed, one on each side of the Straits at a point slightly north of the narrowest point. Each of these towers will be 330 metres in height (a few feet higher than the Eiffel Tower), and the distance between them will be 330 metres. There will be two circuits of three cables each, running 30 ft. apart. The diameter of the cables, which will be of steel, will be .82 in., and the water in the centre will be cleared by a minimum of 70 metres. On one side of the Straits the cables will have a fixed attachment at the base of the tower, on the other an automatic movable one to allow for seasonal expansion and contraction and for wind pressure. The power will be carried at a pressure of 135,000 volts.

The United States Steel Corporation is prepared to begin the erection of the towers within eight months of receiving the order and to complete the work within two years. Further, it is prepared to guarantee the satisfactory working of the scheme for a period of five years after completion and to accept payment accordingly by instalments.

The cost, excluding that of the concrete foundations for the towers, has been estimated in the form of a firm offer at 800,000 dollars.

The capital for this great enterprise has been found by a consortium of the electrical companies chiefly interested, namely, the Società Meridionale di Elettricita, the Società Generale Elettrica della Sicilia, and the Società delle Strade Ferrate Meridionali, backed by the strongest Italian bank, the Banca Commerciale Italiana. The State is assisting, too, with a grant amounting to 200,000,000 lire (close on £2,000,000).

The Timpa Grande power station will be completed, together with the Ampollino storage reservoir, by the close of 1925, although it will not even then deal with the whole of the discharge of water described above. In other words, the extra water to be derived later from the River Tacina will not be included, while in consequence of the other power stations higher up the valleys not being in operation, together with the remaining reservoirs, the whole of the water available at the Timpa Grande will not be regulated, so that the continuous output at the beginning of 1926 will not correspond with the maximum figures given above. Nevertheless, about 30,000 continuous h.p. will be produced in this first stage of development, and progress with the remaining works will continue unchecked.

The Montecatini Co. has secured a site at Cotrone, which is a small port with a safe and deep anchorage close up to the quay side, for the erection of plant utilising the Fauser process for the production of synthetic ammonia. This plant, which will have a load factor of about 90 per cent., will employ about 20,000 kW, and thus form a useful fly-wheel, so to speak, to the total load of the whole hydro-electric system.

Before closing this summary description of this important enterprise we must not forget to mention that, in accordance with the principles enunciated at the beginning of this article, a further storage reservoir is to be constructed below the fourth power station with the object of providing water for the irrigation of the plain lying between the mountains and the sea. The complete regulation of the *régime* of the Neto will already have prevented the seasonal floods. The way will thus be paved for the gradual colonisation of this large and fertile area amounting to over 25,000 acres, hitherto practically deserted on account of lack of water and the malaria scourge, and an industrial agricultural company is being formed to exploit the new situation.

It may be of interest to British readers that the designer of this great scheme, Ing. Angelo Omodeo, is responsible for the plan of hydro-electric development in the Tay valley, known as the Grampian Electricity Supply Scheme, the construction of which, it is announced, will shortly be initiated under the auspices of the Power Securities Corporation.

Largest Synchronous Motor.—According to *Power*, a 9,000-h.p. synchronous motor, to be installed by the McKinney Steel Co. at its River Furnace Plant, will be the largest continuously rated industrial motor in the world. It will be connected to a Morgan continuous billet mill which will probably be in operation early in 1926. The motor will be of the G.E.C. design for 6,600 V, 107 r.p.m., 3-phase, 25 cycles, unity power factor. It will have shaft extensions at both ends and be coupled to a long layshaft running the length of the mill with bevel gearing to each stand of rolls. The mill will have 10 stands, six of which will be 21 in. and the remainder 18 in.

Induction Heating by Low-Frequency Currents.

The Use of the Induction Furnace for Melting Non-ferrous Metals.

By G. E. TAYLOR, A.M.I.Mech.E., A.M.I.E.E.

(*Concluded from page 287.*)

Figs. 6 and 7 show a side and front view of a 75-kVA, single-phase, 50-cycle, 440-volt furnace, having a nominal capacity of 600 lb. per hour.

Two sections of the same furnace are shown in fig. 8. It will be noted that the secondary portion consists of two arms forming an angle of 75 deg. Above them is placed a bath of molten metal, the upper part of each arm being rounded off at the point where it meets the bath.

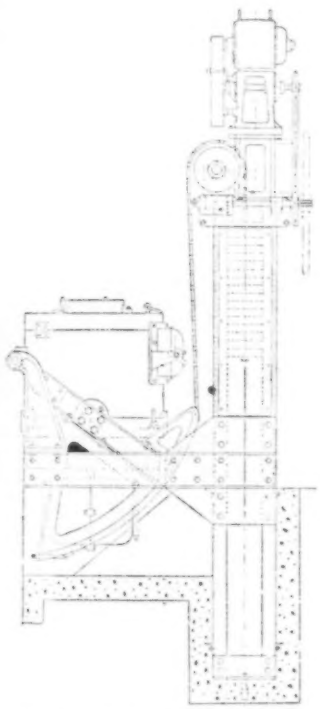


Fig. 6.—Side View of Ajax-Wyatt Furnace.

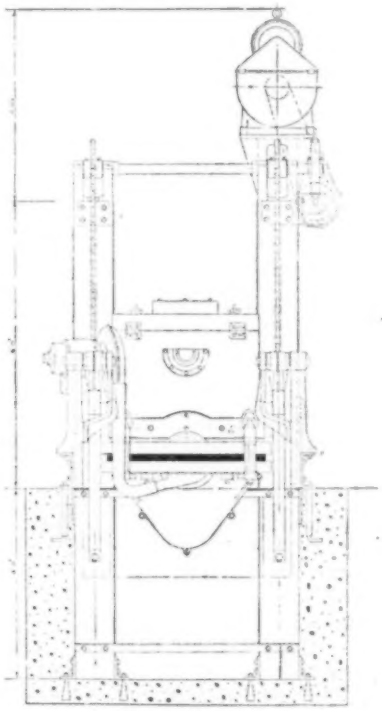


Fig. 7.—Front View.

The resistance of the lower or V-shaped part of the secondary channel is about 80 per cent. of that of the whole furnace. The V-shaped part contains about 21 lb. of metal. As the watt-hours required to raise the temperature of this amount from 950 deg. C. to 1,150 deg. C. (the temperature at which zinc volatilises in the alloy) is 285, it is evident that when the furnace is developing 74 kW, the rate of change of metal in the channel must be 3.5 times per minute to prevent the zinc volatilising. This flow of metal is obtained as described below.

To simplify construction, the furnace has been designed for single-phase working. The maximum kilowatt input of a single-phase furnace is limited, owing to the size of the secondary slot, to 80 kilowatts on 50 cycles and 90 kilowatts on 25 cycles. It may, however, be designed for polyphase working, when the maximum input will be increased in proportion to the phases used.

Conductors carrying current in opposite directions repel each other, if free to move, the magnitude of the force depending directly on the square of the current and inversely on the distance between the conductors.

When the conductors are composed of molten metal contained in rigid channels, this force will tend to bank up the metal on the outside of each channel, and where these are arranged so that a gradually diminishing force is obtained along their lengths, the metal will tend to flow from the adjacent ends. In practice it is found that when the channels form an angle of 75 deg. in relation to each other, a good metal flow is obtained.

As the channels widen out where they meet the bath, the current density at this point is much less than further down the channel; there is, therefore, an increased circulation of the metal due to the "pinch" effect.

The critical current density at which the force known as "pinch" effect will tend to reduce a rectangular conductor to half its cross section, as shown by Hering, will be given by the following formula: $C_D = 895\sqrt{G/H}$, in which C_D is the current density in amperes per sq. in.; G is the specific gravity of the molten metal, and H the depth of metal.

The current in the channel of the furnace shown in fig. 8 being many times greater than that given by the above formula, the "pinch" effect would break the circuit if it were not for the head maintained in the channel by placing the bath of molten metal above it.

The circulation of the metal in the furnace is due to various effects. As the metal becomes heated in the channels and forced to their outer sides, its place is taken by the colder metal flowing in, this flow being due to heat convection currents, or the "Joule" effect. The arrows in fig. 8 show the direction of this circulation. In making copper-zinc alloys, it is necessary that the metal should be well stirred, to ensure having a homogeneous alloy throughout the charge. Where the pit fire furnace is used, the stirring is done by the melter, using an iron bar for the purpose, just before the metal is ready to be poured. With this type of induction furnace, the stirring is automatic and continuous, being caused by the above-mentioned effects, which are of sufficient magnitude to displace the metal at the top of the bath.

The following figures give the electrical characteristics of a 50-cycle single-phase furnace:—

Nominal capacity, 600 lb. of brass per hour.

Input, 74 kW; p.f. 84 per cent.

Primary volts, 440; amperes, 200; turns, 80.

Size of primary copper, 0.125 in. × 0.75 in. (0.0937 sq. in.).

Secondary resistance, 2.9×10^{-4} ohm; amperes, 15,700.

Size of secondary copper, 3 in. × 0.75 in. (2.25 sq. in.).

Flux density in core, 12,000 lines per sq. cm.; in legs, 7,600 lines.

Copper loss (hot), 1,022 W; iron loss, 544 W.

Efficiency, 97.8 per cent.; temperature of primary, 150 deg. C.

The electrical gear external to the furnace, a wiring diagram of which is shown in fig. 9, consists of two

2-pole, change-over oil switches, interlocked with a 12-way plug board. In this case a 75-kVA auto-transformer is used to reduce the voltage from 525 to 440. The 440-volt winding is tapped up to the mid point, and is so connected to the switchgear that any voltage from 0 to 440 volts may be obtained in 20-volt steps. The ammeter and voltmeter are connected in the furnace circuit. It has been found in practice that so great a number of tappings is not required, and the switchgear and auto-transformer have therefore been simplified, as shown in fig. 10. A standard change-over 3-pole 200-A oil-switch, with two series overload trips and low-voltage release, has been substituted for the two 2-way switches, and a 220-kVA transformer with five tappings is used in place of the 75-kVA auto-transformer.

When a single-phase transformer is used to step down the voltage to that required for the furnace, provided this voltage is about 440, a tapping is generally taken out at the mid-point of the secondary winding and earthed as a precautionary measure against shock. When the furnace is connected to a 440-volt supply with unearthed neutral, an earth shield is fitted over the primary winding of the transformer. A 1-h.p. motor is provided for tilting the furnace, and a motor of ½ h.p. is used for driving the transformer cooling fan.

Fig. 11 shows a three-legged furnace transformer on the centre leg of which is placed the winding, consisting of copper strip wound radially on an asbestos sleeve, mica or asbestos insulation being placed between the turns. The whole coil is then covered with a thin layer of special cement.

As the transformer has to be dismantled each time the furnace is lined, the laminations in the centre leg are shaped at the end and are arranged in layers of five to facilitate assembly. A small fan is used to blow air over the centre leg when in operation.

The furnace is lined with a refractory cement, which is rammed into the furnace by means of pneumatic hammers. The bottom castings are placed on a suitable stand and are lined with asbestos sheet and heat insulating bricks. The wood former, which forms the secondary channels, is placed in position and the cement is rammed round it. This is carried on until the cement is of sufficient height to place in position the former, which forms the hole to take the centre leg of the transformer. The bottom brass ring is also placed in position and the lining is rammed up to the point where the furnace shell is bolted on.

The first row of heat-insulating bricks is then placed inside the shell and the ramming is continued up to the point where the crucible form and spout forms are placed in position. Ramming is further continued until the top of the furnace is reached.

The different formers are then taken out, the furnace transformer is assembled, and the furnace is placed in its cradle, and then the channel former is burnt out. The furnace is now dried for a period of three or four days, after which about 200 lb. of molten metal is poured into it and the current is switched on.

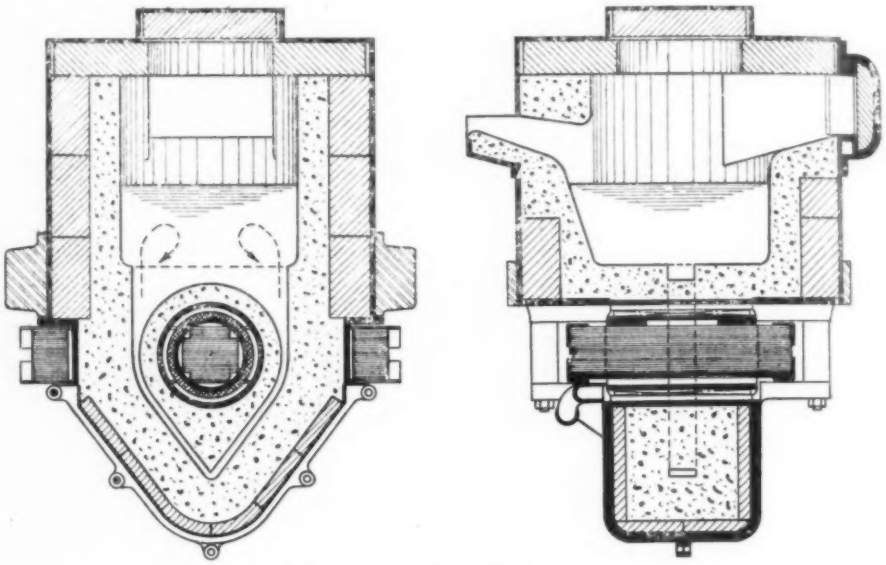


Fig. 8.—Sections of Ajax-Wyatt Furnace.

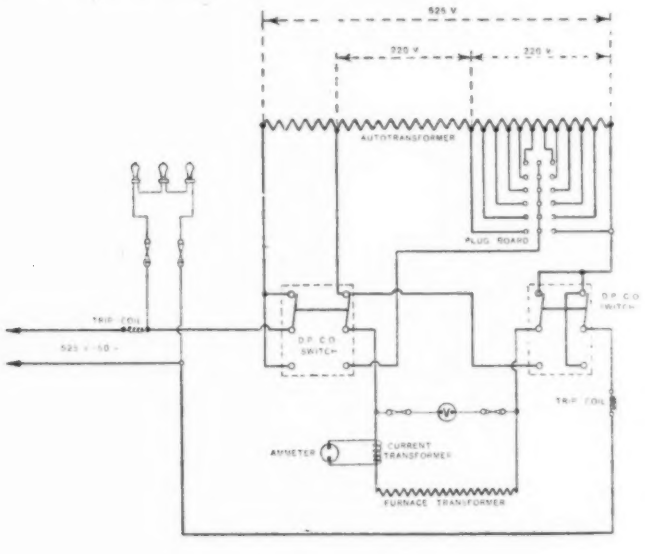


Fig. 9.—Wiring Diagram.

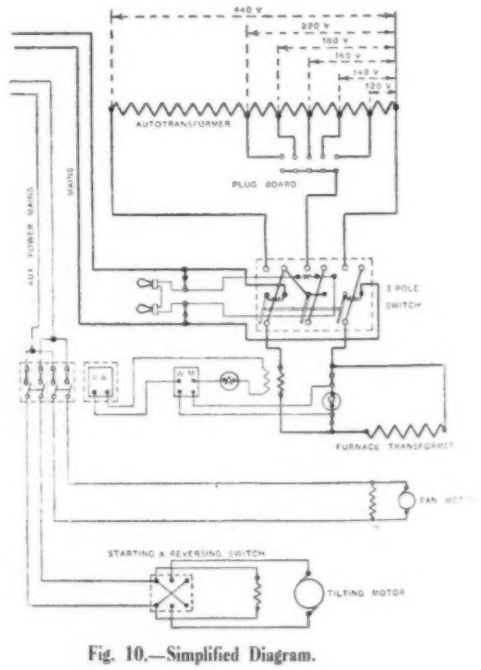
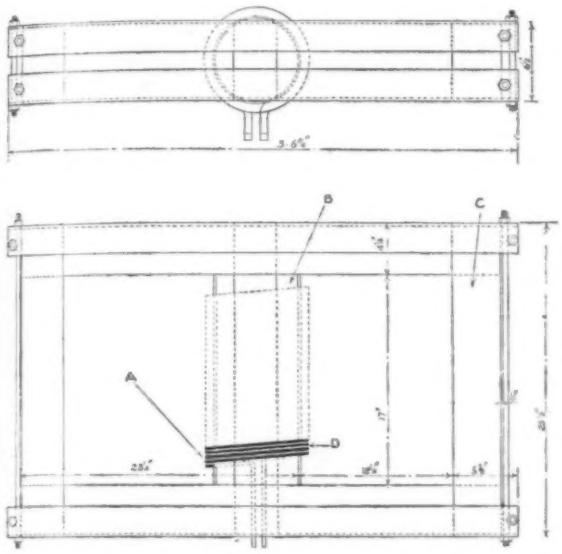


Fig. 10.—Simplified Diagram.

After the furnace is started, it may be charged with swarf, ingots, or scrap metal in any form. When the furnace has been completely charged and the whole of the metal has reached its correct pouring temperature, the needles of the instruments will begin to oscillate, owing to the varying conductivity in the channel. This is very interesting and extremely useful, for it indicates the correct pouring temperature of the metal, and so



A, primary coil; B, core; C, transformer iron; D, high-temperature insulating cement.

Fig. 11.—Three-legged Furnace Transformer.

does away with the necessity for highly skilled melters. This condition only holds good if the size of the secondary channel is made in correct proportion with regard to the power input.

The rate of flow of metal during the pouring operation is under complete control, the tilting of the furnace being carried out by means of a small electric motor. The controller is usually placed in the fixed centre about which the turn-table for the moulds revolves. The melter is therefore in the best position for observing the height of the metal in the moulds during this operation. As the lip of the spout is on the tilting axis, a constant pouring point is maintained.

The following table gives details of an actual day's run on a 65/35 brass:—

Time in hours. Melting.	Melting Charging & Pouring.	Metal chgd. lb.	kWh per charge.	Lb. per unit.	kWh per ton.	Remarks.
H. m.	H. m.					
1 15	1 25	650	75·5	8·85	253	First heat
1 0	1 15	650	61·5	10·55	212	—delay on
55	1 5	650	67·5	9·63	233	moulds.
10	1 20	650	63·5	10·2	220	
1 0	1 13	650	58·5	11·1	202	
1 0	1 12	650	65	10	224	
1 0	1 9	650	58	11·2	200	
7 10	8 39	4,550	447·5	10·2	220	

The metal may be held at any required temperature by means of voltage regulation. As the furnace must be started up on molten metal, the usual practice is to keep it molten over week-ends, the power taken being approximately eight units per hour.

The switching operation is extremely simple, and a single change-over switch only is required, as it is found in practice that only the voltage necessary for giving the full load and that for stand-by are used.

The metal loss due to volatilisation is extremely low, and, if due precautions are taken to keep the furnace airtight, oxidisation may be practically eliminated. It is found that by adding a quantity of zinc equal to ½ of 1 per cent. of the total charge, the proportions of the mixture are maintained.

The energy consumption can be estimated from the above figures, which show that an average of 10.2 lb. of brass per kWh has been maintained throughout the shift, this including pouring time, when it is usual to reduce the load to about 8 kW.

We have, therefore, an energy consumption of 200 kWh per ton. If we take the empirical figure of 15 kW as the rate at which heat is applied to the furnace to keep the total charge at its pouring temperature, we have an efficiency of 78.5 per cent., with a furnace taking 70 kW.

The average life of the lining is approximately 500,000 lb. of brass melted, but in several cases this figure has been as high as 2,500,000, and in one case over 5,000,000 lb. The channels of the furnace do not become enlarged, as might be expected, from the violent circulation of the metal, but gradually make up, and in time the rate of melting becomes too slow for practical use.

Two men, who may be semi-skilled melters, are required to operate a 600-lb. furnace and moulds, when pouring about every hour. Four men are usually employed where banks of three furnaces are installed, and in some cases where a number of furnaces are in use, one man per furnace is found sufficient.

As practically the whole of the resistance is in the secondary channel, the kW input is independent of the quantity of charge in the crucible, and therefore the full rated load may be taken at any state of the charge.

It is usual to run the furnace for 24 hours per day, 5½ days per week. Assuming that it takes the furnace 60 minutes to melt the charge and 10 minutes for pouring time, when the load is cut down to about 8 kW, it is in operation for 108 hours at 70 kW and 18 hours at 8 kW, making a total of 8,424 kWh out of a possible 11,760 kWh, thus giving a load factor of 71½ per cent.

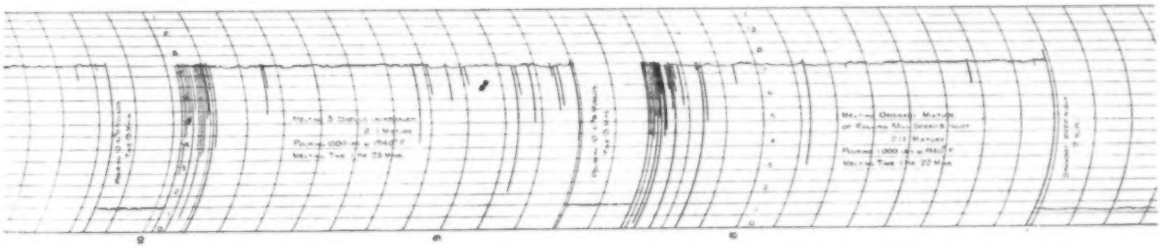


Fig. 12.—Reproduction of Kilowatt Record Chart.

Fig. 12 is a reproduction of an actual kilowatt record chart. It will be seen that the load is practically constant throughout the heat, until the charge is nearly ready for pouring. The load then begins to vary and produces the fluctuations shown on the chart. This is due to zinc volatilisation in the secondary channel. The drop in the curve at the end of the heat is caused by the load being reduced during the pouring. As soon as the metal is cast, the furnace is switched on to full load. Hence the power is practically constant during the melting period and an acceptable load is provided for the power supplier.

This form of induction furnace, which has a power factor of 85 per cent. at 50 cycles and 90 per cent. at 25 cycles, a steady and constant load with a correspondingly high load factor, a high thermal efficiency and a strong stirring action of the metal, is ideal for the making of alloys.

It is not generally realised that about two-thirds of the world's supply of yellow brass for rolling mills is now being made in this type of furnace.

The Southern Railway Electrification.—III.*

High- and Low-Pressure Cable Systems and Sub-Station Equipment.

(*Concluded from p.* 303.)

Electric traction was introduced on the suburban lines of the South-Western section of the Southern Railway in the autumn of 1915. The d.c., 600-volt, third-rail system is used, and the first section comprises 150 miles of single track, or 50 route miles. The second section, which was opened on July 12th last, covers 67 track miles and embraces the company's lines southward to Guildford and Dorking.

South-Western Extension.—For this section 61.1 miles of 11,000-volt cable was manufactured, laid, and jointed by W. T. Henley's Telegraph Works Co., Ltd., in addition to two miles of 7-core, eight miles of 15-core, and four miles of 19-core contol cable. The low-pressure cable was supplied by the Macintosh Cable Co., Ltd.

The track is supplied with d.c. at 660 volts from rotary-converter sub-stations which were equipped by the British Thomson-Houston Co., Ltd., as were the original ones. The most recent additions are four two-unit attended and three single-unit unattended sub-stations, together with extensions at two existing sub-stations and also at the Southern Railway Co.'s Durnsford Road power station, which feeds the sub-stations at 11,000 volts, 3 phase, 25 cycles.

The self-synchronising rotary converters both in the attended and unattended sub-stations have a normal rating of 1,250 kW and run at a speed of 500 r.p.m., being designed to stand overloads of 50 per cent. for two hours, 100 per cent. for five minutes, and 200 per cent. for 20 seconds, and are also guaranteed to stand a momentary load of four times full load without flashing-over. Induction-motor starting is used, and the general construction and arrangement of the switchgear in the four attended sub-stations is similar to that in the old sub-stations and to that described last week in connection with the South-Eastern section.

Special interest attaches to the unattended, or "automatic," sub-stations at Leatherhead, Clandon, and Oxshott, each of which contains a 1,250-kW rotary converter with automatically-controlled switchgear for the a.c. and d.c. ends of the set and the d.c. track feeders. The Leatherhead and Clandon single-unit stations are located at intermediate points in the run of e.h.p. feeders between adjacent two-unit sub-stations and are controlled from the two-unit attended sub-station at Effingham Junction. The Oxshott "automatic" sub-station is situated at the end of an e.h.p. feeder and is controlled from the Hampton Court sub-station.

In each case the 11,000-volt switchgear, which is constructed on similar lines to that in the attended sub-stations, is arranged on two floors at one end of the sub-station, while the 660-volt d.c. switchgear is on two floors at the opposite end of the building, the rotary converter and transformers being located in the central part of the building. The "automatic" apparatus is designed for remote control from a distant point, but provision is also made for control in the sub-station for inspection purposes when required.

To start up the rotary, the remote control switch in the distant station is closed by hand; this operation energises the master control contactor, which is so interlocked that it cannot close unless the motor-operated master controller is in the "off" position. When the master-control contactor closes, the motor-driven master-controller (which fixes the sequences of subsequent operations) closes the oil circuit breaker which connects the h.p. side of the main power transformer to the three-phase e.h.p. supply. Further rotation of the controller closes the "starting" contactor which connects the starting motor to the main transformer, and the auxiliary field winding on the rotary converter is connected to an auxiliary generator, which is driven from the rotary converter shaft. At this point the master controller stops and waits for the machine to synchronise.

As the rotary accelerates, the auxiliary generator builds up its voltage, thus energising the auxiliary field winding and fixing the polarity of the machine. When the voltage of the auxiliary generator attains approximately 80 per cent. of normal, the synchronising field contactor adjusts the resistance in the main field of the converter to the correct value for synchronising. When synchronism is reached, a synchronous-speed indicating relay re-starts the master controller, thus closing a "running" contactor which connects the rotary direct to the transformer, whilst the main field is disconnected from the synchronising tapping on the field rheostat and connected to the moving arm of the rheostat.

Further rotation of the master controller causes the auxiliary field winding to be disconnected from the auxiliary generator; the rotary will now be running in synchronism from the a.c. side, with correct adjustment of field, and will be ready for connecting to the d.c. bus-bars. The master controller, continuing its travel, closes the high-speed breaker on the "negative" side and immediately afterwards the high-speed breaker on the "positive" side closes. Thus, the machine is connected to the d.c. bus-bars. The master controller comes to rest in the "running" position, where it remains until the machine is shut down.

High-speed circuit breakers have been provided to protect against overload and short circuits; they can be set to trip at a predetermined current value and are under the control of a repeat-action relay, reclosing a predetermined number of times, but if the fault persists the rotary converter will be finally shut down and locked out. The other protective devices may be divided into two classes:—(1) Those which shut down the equipment, but do not prevent automatic re-starting when conditions return to normal, and include an a.c. undervoltage relay, machine temperature delay, and d.c. reverse power relay, and (2) those which shut down the equipment either directly or indirectly and prevent automatic re-starting until the device which has operated has been re-set manually; these include an overspeed device, a.c. overload and earth-leakage relay, bearing temperature relay, a sequence-timing relay, &c.

Further, a "single-phase starting" protective relay prevents the machine from starting unless all three phases of the a.c. transmission line are energised. The high-speed circuit breakers controlling the d.c. track feeders are opened and closed by means of a control switch situated in the distant control station, but when this switch is closed by the attendant the breakers are under the control of automatic re-closing relays in the sub-station, operating in a similar manner to that described for the rotary-converter d.c. breakers. Provision has been made whereby once the breakers have been locked out, due to a persistent fault by the operation of the re-closing relays, the locking-out device can be re-set from the distant-control point after the fault has been removed. Indication at the distant-control point is given by a signal lamp to show when a feeder breaker has been locked out due to a fault.

The transformers in the attended and unattended sub-stations are of the British Electric Transformer Co.'s single-phase, oil-immersed type, arranged in banks to form three-phase units.

The new rolling stock for both the Western and Eastern areas has been built to the dsigns of Mr. R. E. L. Maunsell, chief mechanical engineer of the Southern Railway, Messrs. Herbert Jones and A.

* Elec. Rev., April 10th, June 5th, and August 21st, 1925.

Raworth, the respective electrical engineers, having been responsible for the electrical equipment. The motor unit formation is similar, comprising one trailer coach arranged between two motor coaches and, during the busy periods of traffic, two of these units are coupled together and augmented by a two-coach trailer unit. For the Western section, 52 motor coaches have been built by the Metropolitan Carriage and Wagon Co. and 26 trailer coaches by the Midland Railway Carriage and Wagon Co. The motor and trailer coaches for the Eastern section have been supplied by the Metropolitan Carriage, Wagon and Finance Co. and the Birmingham Railway Carriage and Wagon Co. respectively. The stock for the two sections differs only in detail and dimensions.

In addition, over 500 existing vehicles have been reconstructed as motor and trailer coaches in the railway company's works at Ashford. These vehicles are mounted on new underframes exactly similar to those of the new stock, and the passenger-carrying capacity is identical; 144 existing bogie vehicles have also been adapted to act as two-coach strengthening units for addition, when required, to the regular three-coach electric units of both the Western and Eastern sections.

For the Western section, the order for the complete electrical equipment of 26 three-coach trains and 13 two-coach trailer units was placed with the Metropolitan-Vickers Electrical Co. Each of the three-coach trains will consist of two motor coaches, one at each end and one trailer coach in the centre. Each motor coach is equipped with two motors, each giving an output of 275 h.p. at 600 volts on the one-hour rating, arranged in pairs on the bogies underneath the driving compartments. Each pair of motors is controlled by its own separate gear in the driver's compartments. One advantage claimed to be obtained by placing the control gear in the driver's cab directly over the motor bogies is that the weight of the apparatus is concentrated above the motors, producing more adhesive weight upon the driving wheels and reducing the possibilities of slipping under bad track conditions. Westinghouse brakes are used; the air is supplied by small compressors, directly driven by low-speed motors, one of which is placed in each motor cab. The action of all the compressors on a train is controlled by a master governor and switch producing uniform work on all the compressors, as all start and stop simultaneously.

In conclusion, the following table may convey an idea of the Southern Railway's electrification plans:—

Section.	Track miles completed.	Track miles in hand.	Total miles.
L. & S.W. ...	178	67	245
Brighton ...	70	82	152
S.E. & C. ...	—	250	250
Cost ...	£2,250,000	£5,500,000	£7,750,000

The conductor rails on the Elmer's End and Hayes line were recently charged at a d.c. pressure of 600 volts in connection with preliminary tests which will be continued at intervals till the electrified portion is ready for operation in, it is hoped, December next.

CORRECTION.—The three 400-kVA frequency changers in the Lewisham sub-station and 15 10-kVA sets in the outlying sub-stations, mentioned last week, were manufactured by the Electric Construction Co., Ltd.

Notes from Canada.

(By our Special Correspondent.)

In the issue of the REVIEW dated July 3rd, is an editorial entitled "Standards of Quality and Performance." It is rather noticeable that no mention is made of the Approval Laboratories of the Hydro-Electric Power Commission of Ontario which have now been functioning, in a manner similar to that of the Underwriters' Laboratories in the United States, for over 10 years.

The following statement, quoted from the article in question, does not apply to the Power Commission's approval for Ontario so far as the writer has been able to ascertain:—

"Matters are so arranged that it is almost, if not quite, impossible for a British or other manufacturer to secure the services of the Bureau."

Whether electrical materials, apparatus, or devices, &c., have been approved by the Underwriters' Laboratories or not, the Commission's approval must be obtained, though, usually, the Commission approves anything already approved by the Underwriters, whilst reserving the right of independent action. Moreover, the legal authority vested in the Commission. by the Provincial Legislature, under the provisions of the Power Commission Act, enables the Commission not only to prevent the *use* of unapproved electrical apparatus, but also to prevent its *sale* for use in the Province; the Commission has also power to prevent the advertising of electrical apparatus (even though it be approved) in such a manner as would be liable to lead to improper use. For example, a manufacturer or dealer would not be allowed to advertise a 1,000-watt electric heater as being suitable for connection to an ordinary lampholder, for such holders are rated at only 660 watts. There is little doubt that such restrictions will work to the benefit of the community. A case that was mentioned to the writer some time ago may serve as an illustration:—

A pair of electric curling tongs was purchased, and shortly afterwards a small child in the household got hold of the flexible cord, while the tongs were connected up, and bit it, with the result that his mouth was very badly burned. Investigation showed that the cord had no rubber insulation whatever, and was not fit for anything more than electric bell work; there was nothing on the device to indicate its country of origin, and its whole construction was such as to invite trouble. The device was bought at a "department store" in an Ontario city.

The Hydro-Electric Power Commission now has power to prosecute anyone found dealing in such unapproved devices for, of course, the one in question had never received its approval. Several persons have already been prosecuted and fined, and the results are said to be salutary. While the approval of the Commission is only required *by law* in the Province of Ontario, the writer is informed that its approval is usually sufficient to gain acceptance of a device in other Provinces without difficulty, even though the approval of the Underwriters' Laboratories in Chicago has not been obtained.

With regard to the work of the Underwriters' Laboratories and also to the National Electrical Code, it has always seemed to the writer to be unfortunate that it is only the fire and not the life insurance companies that are represented.

The natural tendency of the fire underwriters is to take care of the fire risk only, in connection with either electrical installations or apparatus, and though of recent years an honest attempt has been made to pay attention to the life hazard as well as the fire hazard, it is still evident that the latter gets more consideration than the former.

If there is a move in England to establish some form of approval, and to do it through the agency of the insurance companies, by all means let both the great branches of the insurance world be adequately represented, otherwise there will be a lack of proper balance.

[The constitution and working of the Approval Laboratories of the Hydro-electric Commission were described in the ELECTRICAL REVIEW of April 29th, 1921.—EDS.]

D

The British Association.—I.

The Southampton Meeting.

On Wednesday last, the 95th annual meeting of the British Association for the Advancement of Science commenced at Southampton. In a number of respects this important sea-port is an ideal *venue* for such a congress, as within it and around are many things in wide variety to interest the scientific mind. The town is the home of the Ordnance Survey, to whose premises visits are being arranged; archæologists will find a great many matters to occupy their attentions; the New Forest provides material for the naturalist; while there are many undertakings exemplifying modern industrial and engineering progress. From our readers' point of view there are three works of outstanding interest in Southampton: the docks and harbour, the Pirelli-General Cable Works, and the Corporation electricity works. In the Engineering Section (G) papers are being read upon the first and last of these by gentlemen very competent to deal with them—Mr. H. Wauchope, the electrical engineer to the Southern Railway at the Southampton Docks, and Mr. W. G. Turner, the borough electrical engineer. The programme of visits and excursions includes visits to the docks and the Pirelli-General works, as well as to the Calshott Aerodrome, Messrs. Harland & Wolff's ship-repairing works, &c.

It is of interest to recall that the Association has previously paid two visits to Southampton—in 1846 and 1882. The programme in the latter year contained a large number of papers on electrical subjects, which was fitting when the president was Dr. C. W. (afterwards Sir Charles) Siemens. Reference to the Electrical Review of that period shows that the presidential address referred to the "new arts of applying electricity to lighting, to the transmission of power, and to metallurgical operations." A large part of the address was concerned with electrical units, and it was then suggested that the unit of electrical power should be named the "watt," and the terms "gauss" and "weber" were suggested for magnetic units. Dr. Siemens predicted that "the electric light may be worked by natural sources of power, such as waterfalls, the tidal wave, or the wind," a prophecy which has been abundantly fulfilled in two respects at least. A study of the papers presented at the meeting is very fascinating, but we cannot do more than indicate the nature of a few of them. Mr. F. J. Sprague described the Edison system of electricity distribution dealing with dynamos, lamps and meters; Mr. W. H. Preece read papers on "Recent Progress in Telephony" and "A New Arc Electric Lamp"; some "Notes on Atmospheric Electricity" were contributed by Mr. C. Michie Smith; Mr. R. Sabine dealt with electric light measurement; Lord Rayleigh presented a report of the Committee on Electrical Standards, dealing principally with the effect of temperature upon the resistance of metals; Mr. C. Vernon Boys described the principles of some electricity meters; and Dr. Siemens and Mr. A. K. Huntington presented a joint paper on the electric (arc) furnace.

This year's president is Dr. Horace Lamb, F.R.S., who was formerly professor of mathematics at Adelaide and Manchester. The president of Section G—Engineering—is Sir Archibald Denny, the well-known naval architect and marine engineer; the vice-presidents of the Section are Prof. G. W. O. Howe and Sir J. I. Thornycroft, F.R.S. Dr. G. C. Simpson and Prof. C. H. Desch are respectively presidents of Sections A—Mathematics and Physics and B—Chemistry. There is one woman president this year, Miss Lynda Grier, principal of Lady Margaret Hall, Oxford, who is presiding over Section F—Economic Science and Statistics.

The proceedings were to be opened on Wednesday evening with the inaugural general meeting at the Central Hall, at which Major-General Sir David Bruce was to relinquish the chair in favour of Prof. Lamb. The new president's address dealt with certain branches of geophysics, the structure of the earth being treated from the physical and mathematical aspects.

The real business was to begin on the following morning (Thursday), the sessions of all Sections opening at 10 a.m. The addresses of the Sectional presidents have again been spread over the programme, so that it is possible for those attending the meeting to hear more than one of the addresses if they desire, which was impossible under the old arrangement, by which they were all read at the opening session. The business of the Engineering Section was wholly marine. Sir Archibald Denny was to deliver his address, entitled "Fifty Years' Evolution in Naval Architecture and Marine Engineering," of which an abstract follows; this was to be followed by two or t...ee papers on marine engineering subjects, and in the afternoon members of the Section were to visit the Southampton Docks.

The proceedings on the first day contained little of electrical interest, though a number of papers dealt with subjects in which the nature of electricity entered, as in a communication by Prof. L. S. Ornstein (Section A) on "Light Quantum Theory of Dispersion," while others might conceivably have electrical applications, *e.g.*, the paper on "Advances in the Treatment of Peat as a Fuel and the Production of By-products," by Dr. F. M. Perkin (Section B). Mention may also be made of a study of "The Resistance to Corrosion of Electro-Deposited Chromium," by Mr. E. A. Ollard (Section B); and a paper on metal-mining in Cornwall by Mr. E. H. Davison (Section C—Geology).

This year, as usual, "Citizens' Lectures" have been arranged for the general public. There are four of these, including one by Prof. E. V. Appleton on "The Rôle of the Atmosphere in Wireless Telegraphy" and another on "Some Technical Problems of Broadcasting," by Capt. P. P. Eckersley, chief engineer to the British Broadcasting Co. Between twelve and thirteen hundred members of the Association had, prior to the meeting, notified their intention to attend.

Fifty Years' Evolution in Naval Architecture and Marine Engineering.

(*Abstract of Presidential Address, Section G.—Engineering.*)

As can be gauged from its title, this address dealt principally with the construction and propulsion of vessels during the last half-century, and only in parts was it of direct electrical interest. After dealing briefly with the types of engines in use between 1854 and 1890, the author said that the introduction of the Parsons turbine was a great advance. His first connection with the turbine was in 1890, when a small machine was used to drive a dynamo aboard the *Duchess of Hamilton* on the Clyde. It was a tiny plant, the turbine driving the dynamo direct at 10,000 r.p.m.; it was not very economical, but as it was only used rarely on evening cruises, that did not matter much. It was, however, a forerunner of that great invention, permitting the economical use of the low end of the pressure curve which could not be efficiently used in the reciprocating engine, thus improving the economy of the steam engine, apart from the other advantages of freedom from vibration troubles and increased speed which could be obtained through its low weight per h.p. After briefly mentioning the first turbine-driven ships, the author said that there was no means of indicating the turbines prior to 1902. In that year the *Queen Alexandra* was put into service and an attempt to measure the torsion of the shaft was made. This was done by means of a telephone and contacts on the shaft at considerable distances apart. The system had been successfully tested on

a works shaft at about 200 r.p.m., but at the higher speed it was not at first very successful. Thereafter an induction method, with permanent magnets and coils, designed by Mr. Chas. Johnson, was used for some time with success, but the structure of torpedo boat destroyers upset the arrangement, which depended for its success upon a very small clearance between the coils fixed to the hull and the sharp permanent magnets fixed on the shaft. The Hopkinson-Thring instrument, using only a short length of shaft, with mirror and light arrangement, was much used; and, also using a short length of shaft, Edgcombe constructed an averaging electrical meter which had the great advantage of requiring only one reading even on the shaft of a reciprocating engine. There were now several types of meter which could be used with confidence. A part of the address was devoted to the development of the Diesel engine, and it was mentioned that the tonnage of motor ships had risen from 750,000 in 1919 to 2,000,000 tons five years later. The author said that mention was frequently made of an internal-combustion turbine; while he admitted that he was sceptical as to its practicability, he was sure that there could be no halt in invention and advance in thermal efficiency.

Reference was made to advances in other branches of marine engineering, particularly boilers and condensing arrangements, and the author said that in no direction had advance been greater than in the use of electricity on board ship. Swan and Edison invented the carbon-filament lamp in about 1880, making domestic and ship lighting a possibility. In 1884 the *Arawa* and *Tainui* were fitted with incandescent electric lighting, but stand-by oil lamps were also provided because of the liability to failure of the electrical plant. In those days the switches were made with wooden bodies and there were no quick-break arrangements; sectional switchboards and fuseboards were unknown; soldered joints on trunk wires insulated with rubber tape were made, and the wire available was little better than modern bell wire. The two dynamos were a.c. ribbon-armature Ferranti machines. That was fortunate, because, as the wiring was poor and the skin of the ship was used as the return, had the current been direct there would have been great danger from electrolysis and consequent fires. The total output was about 30 h.p. Nowadays hundreds of kilowatts was used on a vessel of the same size, not only for lighting but for ventilating, local heating, cooking and for driving small machinery of all kinds, including frequently many of the important engine-room auxiliaries. There was considerable controversy as to whether the main dynamos should be driven by Diesels or steam engines, and, in the case of steam, whether it should be drawn at same stage from the main engines before going to the auxiliary, or passed to the main engine after going through the auxiliary, or the exhaust of the auxiliary used for heating the feed water, or a combination of these arrangements. It would be interesting to watch the development of that controversy, as on its proper solution further economy in full consumption would result. Probably no one solution would suffice and in Diesel motor-ships we might find the auxiliaries driven by steam—*e.g.*, when they were oil tankers requiring the steam to heat the cargo oil—while in steam-driven turbine steamers we might find the auxiliaries driven by electricity generated by Diesel-driven dynamos. The auxiliary machinery in the engine room was now very extensive and the fuel consumed in developing their power was such an important proportion of the total fuel consumed that their design and installation was becoming, to a certain extent, a separate branch of engineering.

Leaving the engineering side, Sir Archibald turned his attention to the design and construction of the ship itself. He showed how great had been the advance in the provisions for the comfort and convenience of the passenger. The old candle lamps, swinging in gimbals at the mirror or fixed in the bulkheads, one for each two cabins, which at best made darkness visible, had been replaced by powerful electric lights, one or more to each stateroom, with probably a reading lamp at the head of each bed. Artificial ventilation, either with fans in each stateroom, or with trunk ventilation fed by powerful main fans supplying air warmed or cooled as desired, was now fitted. Hot and cold water laid on to each stateroom had taken the place of the old "goglets" and receivers. The navigating bridge of a modern high-class steamer was an inspiring sight, with gyro compass probably fitted with an automatic quartermaster, "tell-tales" from the engine room giving the revolutions of the engines and the direction of turning; similar "tell-tales" to the rudder head showing the angle of the tiller; the steering gear, now fitted aft, and controlled by a "telemotor," invented by A. B. Brown, of Edinburgh; there were radio rooms and radio direction finders, and, probably, underwater microphones for finding the position from underwater land bells; probably a telephone system linking up the bridge with the various chiefs of departments; automatic indicators showing the water in all holds and ballast tanks; and means for closing all watertight doors below deck in the event of fog or collision.

Light Quantum Theory of Dispersion.

By PROF. L. S. ORNSTEIN.

(*Abstract of a Paper read before Section A.—Mathematical and Physical Science.*)

If we want to discuss the equilibrium of electrons and radiation from the point of view of light quantum hypothesis, it is necessary to put the probability of collision of an electron and a light quantum proportional to the square of its "wave length." This result leads us to the hypothesis that a light quantum is a spherical volume of electromagnetic energy with dimensions of the order of wave length. This hypothesis may be used in order to find the refractive order. If a light quantum strikes over an atom a force will be exercised on the quantum which is proportional to the volume of the atom and to the gradient of the field in the quantum. The order of magnitude of this gradient may be estimated from the hypothesis mentioned. During the interaction the momentum of the quantum is put proportional to $hc/\lambda v$ (h Planck constant, c velocity of light in ether, v velocity in the quantum and λ wave length). From the above the retardation of a quantum by an atom can be calculated; and taking into account the probability of collision with the atoms the ordinary formula for the refractive index for long waves can be obtained. On the same base the Rayleigh formula for the scattering of light can be found.

In the light quantum theory, dispersion can be obtained by taking into account—just as in the old theory—the inertia of the electric masses in the atom. The influence of damping by radiation, which plays a part in the old theory, also finds its counterpart in our light quantum considerations.

The History of Cornish Mining.

By E. H. DAVISON.

(*Abstract of a Paper read before Section C.—Geology.*)

The history of Cornish mining is a record of progress in mechanical invention making it possible to work new types of ore deposits. The ore bodies of Cornwall consist of alluvial gravels and deep lodes. In the beginning, mining in Cornwall was restricted to the working of alluvial gravels and of lodes at their outcrops. The impossibility of raising water from any depth prevented deep mining all through the Middle Ages. The use of adits to drain away the water was, however, developed along the coast in the sixteenth and seventeenth centuries, and to some extent made use of in the inland mines. Till the middle of the eighteenth century mines seldom worked below 100 feet. The invention of pumping engines by Savory, Newcomen, Watt, Trevithick and others during the eighteenth century rapidly extended the depth to which mines could be worked. After that the chief factor which determined the type of ore deposit worked was the value of the metal. At first, copper was the more valuable metal, and the lodes were worked in the copper zones, tin being considered a by-product; then, when foreign copper ores reduced the price of that metal, the copper mines were either abandoned or carried down into the tin zone, thus becoming tin mines. Of late years, the older mines in the Camborne-Redruth area have become more or less exhausted, and deep development to the north has been carried out on the basis of geological forecast. This development is now in process, but has been successful already in one instance. The available mineral wealth of Cornwall, so far as tin is concerned, is of two types:—(1) The unworked tin zones below abandoned copper mines; and (2) Lodes some distance from the granite outcrop, which carry tin at depths which were too great for profitable mining in the past.

Legal.

Colwyn Bay U.D.C. v. Llandudno and Colwyn Bay Electric Railway, Ltd.

THIS action was mentioned to Mr. Justice Finlay in the Vacation Court on August 19th, on a motion for an interim injunction restraining the defendant company, until the trial of the action, from running tramcars on Sundays in alleged breach of an agreement of 1906.

Mr. E. W. CAVE, K.C., on behalf of the Council, stated that the agreement had been observed by the company until within the last few weeks, when it began to run Sunday cars.

Mr. G. B. HURST, K.C., for the company, said that he desired time in which to answer the affidavits. It was a matter of the greatest importance to his clients as they had been running the cars every Sunday since June 21st, and they wanted the matter disposed of quickly.

Mr. JUSTICE FINLAY said it was obviously a case which should be disposed of promptly; he allowed the motion to stand over until August 26th.

Dublin and Lucan Electric Railway.

MR. JUSTICE HANNA, in the Free State High Court, Dublin, recently appointed Mr. P. McDowall Grosart provisional liquidator in the matter of the Dublin and Lucan Electric Railway, with power to negotiate for the sale of the undertaking as a going concern, and to protect the assets and property of the company. A petition for the winding-up of the company was allowed to stand over.

Tempering of Bronze.—According to the *Mining Journal*, it is reported from Stockholm that after many years' experiments, M. O. Gustafsson, an Oskarshamn foundry foreman, has invented a method of tempering bronze to the hardness of steel.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Employment During July.—The review of labour conditions during July which appears in the August *Ministry of Labour Gazette* states that employment in the engineering industry generally remained bad and showed a slight decline in practically all sections. Conditions remained fairly good in electrical engineering, however. The percentage of unemployed in the whole of the engineering industry was 11.4. In marine engineering it was as high as 20.3 per cent. and in general engineering and engineers' iron and steel founding the figure was 12.4 per cent. On the other hand, the electrical branch had a percentage of 6.0 unemployed, as compared with 5.6 in June, and 6.0 in July, 1924. There was an increase of 0.6 to 8.6 per cent. in the proportion of unemployed in the wiring and contracting industry, but in the electrical cable, wire, and lamp manufacturing group, there was a fall of 0.5 to 7.2 per cent.

A Report Upon Hungary.—The Department of Overseas Trade has received a report upon the commercial and industrial situation in Hungary (Stationery Office, 1s. 6d. net) from Mr. E. C. D. Rawlins, the British Commercial Secretary at Budapest. In an introduction it is said that, although at the beginning of 1924 the general economic condition of the country was far from good, the end of the year brought hope and promise for the future. This is attributed to the programme of reconstruction, assisted by an international loan, and the appointment of the Commissioner-General of the League of Nations. Another favourable feature of the year was the abolition of a mass of trade prohibitions and restrictions and licences, which had led to retaliatory tariffs and proved a hindrance to trade. It has been stated that taxation has reached its highest point and cannot be further increased. The Budget for 1924-25 included an allocation for the laying of a telephone cable between Budapest and Vienna, which is expected ultimately to cost 10 million kr. (gold). An appendix to the report contains particulars of foreign trade during 1924. It is seen from this that 11,018 quintals of electrical machinery and apparatus was imported during the year. The bulk of this came from Germany (46 per cent.) and Austria (40 per cent.); Great Britain's share was only 0.29 per cent. of the total. The exports of electrical machinery totalled 3,951 metric tons, valued at 17,400,000 kr. (gold). It is stated that the Austrian machine industry has good prospects, as stocks are beginning to be exhausted, and all those household articles which were previously supplied by Bohemia and Austria, or by other foreign countries, can now be manufactured by local factories. The industry appears to be able to compete with foreign products, and especially is this true in the case of agricultural machinery, electrical machinery, and equipment, internal-combustion engines and steam engines. Among other details of development, it is mentioned that three automatic telephone exchanges are under construction for Budapest.

The Leipzig Fair.—The German Customs authorities are making special arrangements for inspecting the baggage of visitors to the Leipzig International Fair (August 30th to September 9th) on the trains instead of at the usual bureaux. The Fair embodies a section devoted to the display of small electric power plant for country house and institution lighting, including water-turbine installations.

Local Exhibitions.—STOCKPORT.—An Ideal Homes and National Trades Exhibition is being organised by Mr. I. Batley, Gorsey Works, Stockport, for the period from September 16th to 26th.

HANLEY AND OXFORD.—Modern Housekeeping Exhibitions are being organised in these towns by Messrs. Gibson, Life and Co., St. John's House, 3, Fulwood Place, Holborn, W.C.1, in the first case from November 11th to 24th, and in the case of Oxford from December 11th to 22nd.

E.D.A. Activities.—The British Electrical Development Association has sent us a copy of a coloured poster (E.D.A. 571) which it has recently produced to encourage the use of electricity for cooking. This bears a picture of a lady using an electric cooker, and informing the reader that "I cook my food the electric way for a unit a day." If the charge per kWh is one penny, the Association will substitute "a penny" for "a unit" in the "slogan."

Contribution to E.D.A. Funds.—The Radcliffe District Council, at its meeting last week, decided that the Electricity Committee should contribute £35 (one-tenth of 1 per cent. of the total income of the undertaking for the year ended March 31st, 1925) towards the publicity campaign promoted by the British Electrical Development Association, subject to the sanction of the Electricity Commissioners.

Buenos Aires Subways.—A message from Mr. G. Ward Price which appeared in the *Daily Telegraph* last week, stated that if the contract between the Intendente of Buenos Aires and the Anglo-Argentine Tramways Co., Ltd., for the construction of two underground railways at a cost of £10,000,000 was ratified by the Municipal Council, the whole of the material needed for the works would be bought in England.

Book Notices.—"*Journal* of the American Institute of Electrical Engineers," Vol. XLIV, No. 8, August, 1925. New York: The Institute. Price $1.

"*Journal* of the Institution of Electrical Engineers," Vol. LXIII, August, 1925. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"The Theory of Electric Cables and Networks," by Dr. A. Russell. Third Edition. Pp. xii + 356; figs. 88. London: Constable & Co., Ltd. Price 24s. net.

The Technology Reports of the Tôhoku Imperial University, Sendai, Japan. Vol. V, No. 2, 1925. Maruzen Co., Ltd.: Tokio and Sendai.

Scientific Papers of the Institute of Physical and Chemical Research, Tokio, Japan.—Nos. 32 and 33, June, 1925; Nos. 34, 35, and 36, July, 1925. The Institute.

"Japanese *Journal of Engineering*." Abstracts of the National Research Council of Japan, Tokio. Vol. I, 1921; Vol. II, 1922. The Council.

The Oxford University Press has issued a list of books on science and technology, which includes a number of works on electrical and radio matters.

Lead Market Report.—Messrs. James Forster & Co., in their letter dated August 22nd, say:—"Closing prices yesterday were £39 for August, and £37 1s. 3d. for November, against £37 12s. 6d. and £36 6s. 3d., respectively, at the end of last week. The feature of the market this week has been the daily widening of the backwardation, which accurately registers the shortage of early arrival lead. The Mexican lead has at last arrived in London, totalling about 2,500 tons, but this, as we anticipated, had not the slightest effect on the market, as it was all sold to consumers long ago. The American price was advanced another 25s. a ton this week, and it is reported that, owing to the recent heavy sales to Germany, there is no more American lead available before November delivery. If this proves to be the case, we must anticipate an even more stringent position than at present during the next two months, with the prompt price going to a still higher premium over forward. There seems nothing to prevent the price going over £40 a ton again."

Electrical Development at Greenock.—The chief engineer and manager of the Greenock Corporation electricity undertaking (Mr. F. H. Whysall) has sent us a copy of a booklet which has been sent to all domestic consumers. This sets out in an attractive manner the methods of charging adopted which, it is seen, are very reasonable. The principal system is based on the normal consumption for lighting in houses of various sizes; this is charged for at the lighting rate, and all energy consumed in excess of the stated quantity is subject to the heating rate. Another system employs a fixed weekly charge, again based on the size of the house (number of apartments), and a secondary charge of ¼d. per kWh. Energy for water-heating between the hours of 10 p.m. and 6 a.m. is charged for at the rate of ¼d. per kWh.

Mannesmann Interests in Morocco.—Prior to the war the German Mannesmann seamless tube concern obtained concessions in Morocco by which it was hoped to obtain sufficient copper, zinc, and lead to make Germany independent of other foreign supplies of these metals. By the Versailles Treaty, the firm lost its concessions in French Morocco, and the subsequent disturbances in the Spanish zone have rendered development impossible. According to the *Financial Times*, efforts were made to sell the concessions first to French and then to Spanish interests, but these proved unsuccessful. The Mannesmann concern is now in negotiation with an Anglo-American group whose identity has not been divulged.

The United States and the British Radio Market.—In a review of the radio situation in Great Britain, *Commerce Reports* says that the restriction of the use of foreign apparatus under the original broadcasting regulations enabled British manufacturers to develop and "dig themselves in," and they thus gained an effective control of the market. The position of the industry is so strong that only in the cases of loud speakers and headphones is competition seriously felt. "It should be apparent to American manufacturers desiring to sell radio goods in the British market that there is no opportunity to sell any appreciable quantity of goods of ordinary manufacture. Imported sets or parts must make an exceptionally strong appeal, either on the basis of their efficiency or uniqueness or because of unusually low prices for unquestionable value." "Next to the United States and Canada, Great Britain is probably the most highly developed radio market of the world."

Domestic Appliances for British Columbia.—The Department of Overseas Trade announces that Mr. L. B. Beale, Trade Commissioner at Vancouver, is at present in this country and will attend at the Department, 35, Old Queen Street, S.W.1, from August 31st to September 4th. He is desirous of meeting manufacturers of goods of a number of classes among which are household electrical fittings and utensils. Interviews can only be given by appointment and applications should quote reference 5832/T.G.

Fires.—There was an outbreak of fire at the premises of Messrs. William Geipel & Co., The Borough, S.E., on August 21st, the third floor of the building being destroyed. The situation of the building made the work of the fire brigade very difficult, but the flames were subdued in a comparatively short time.

On the previous day considerable damage was caused by fire at the works of Messrs. Pratt Bros. (Edinburgh), Ltd., electrical contractors, West Park Place, Dalry Road, Edinburgh. In this case the firemen were hampered by dense fumes from burning celluloid in a battery-charging room in which the fire is believed to have originated.

British Cable in Madeira.—In all parts of the world British cables are known and respected, and even where transport methods are of a primitive nature they can be found, for instance, in Madeira. The accompanying illustration shows a

Pirelli-General Cable in Madeira.

part of an order for five miles of 6,600-V, three-core p.i.l.c. and armoured cable made by the Pirelli-General Cable Works, Ltd., for the Madeira Electric Lighting Co. Yoked oxen are seen hauling a drum over a viaduct which forms part of the Rue da Ribeira, Funchal.

Bankruptcy Proceedings.—A. O. JOYCE, 7, Parade, Leamington, Warwickshire, electrician.—The public examination of this debtor was held on August 19th, at the Shirehall, Warwick. Debtor said the delay in the opening of the Daventry station had contributed to his failure. He had formerly travelled for a well-known firm of radio manufacturers, and he knew from experience that when the Bournemouth station opened the sales in that area increased by anything up to £100 net weekly, and in the case of Plymouth they went up by £75. The announcement that Daventry would be opened in March was the sole reason for his commencing business at Leamington on his own account. The statement of affairs showed gross liabilities of £315, of which £310 was expected to rank, against net assets of £19, leaving a deficiency of £291. The examination was closed.

T. BARTON, electrical engineer, Electric Works, Ainsworth Street, Blackburn.—First meeting, August 28th, at the Official Receiver's offices, 11, Winckley Street, Preston. Public examination, September 16th, at the County Court, Blackburn.

J. BENSON, electrical engineer, late of 2a, Wade Street, Leeds.—First meeting, August 27th, at the Official Receiver's office, 24, Bond Street, Leeds. Public examination, October 1st, at the County Court House, Leeds.

H. P. GALT, electrical engineer, 56, Norbury Road, Thornton Heath. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released, July 23rd.

J. COWAN (Cowan & Cox), merchant of electrical appliances, 35-7, Dickenson Street, Manchester.—Last day for proofs for dividend, August 27th. Trustee, Mr. J. Sykes, 30, Belgrave Place, Stalybridge.

B. E. DIXON (Creswick Dixon Electric Co.), Bodega Buildings, High Street, 101a, Albert Road, 451, London Road, and 63, Chesterfield Road, Sheffield, and Electric House, Knifesmith Gate, Chesterfield.—Last day for proofs for dividend, September 2nd. Trustee, Mr. C. Turner, 155, Norfolk Street, Sheffield.

ROBERTS & Co., electrical engineers, 61, Old Town Street, Plymouth, and Fore Street, East Looe.—First meeting, September 3rd, at 5, Princess Square, Plymouth. Public examination, October 16th, at the Western Law Courts, Plymouth.

Private Arrangement.—R. C. & A. H. YELDON, dealers in electrical and radio goods, 20, New Road, Portsmouth.—A meeting of the creditors of the above was held on August 19th, at Portsmouth, when the chair was occupied by Mr. M. P. Houstoun, of Messrs. Corfield & Cripwell, Balfour House, E.C. It was reported that the liabilities amounted to £384 and the assets totalled £572. The debtors started business about three years ago in partnership, the elder brother having a capital of £200. They carried on the business successfully until the beginning of this year, when, owing to the slump in the radio trade, it was found difficult to carry on. The turnover had been about £50 weekly, but latterly it had fallen considerably. The expenses, including drawings, amounted to about £10 per week. The chairman stated that the debtors had executed a deed of assignment to Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, as trustee for the protection of the assets. The debtors stated, however, that they would be able to carry on the business and discharge their liabilities in full. It was decided that the debtors should execute a composition deed to Mr. Osborne as trustee with a committee of inspection, the deed to provide for payment by the debtors of the sum of £30 a month by weekly instalments of £7 10s. until the whole of the liabilities were discharged in full. The following are creditors :—

	£		£
General Electric Co., Ltd. ...	101	S.D.H. Mfg. Co.	23
Brown Bros., Ltd.	29	Silvertown Co., Ltd.	47
Webber, J. M., & Co.	36	Hobday Bros.	33

Company Liquidations.—CHASE ELECTRICAL MANUFACTURING CO., LTD., 195, Archway Road, Highgate, N.19, and at Hornsey.—A meeting of creditors was held recently at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., when the chair was occupied by Mr. W. A. J. Osborne, who stated that the shareholders had passed the necessary resolutions for voluntary liquidation and had appointed him to act as the liquidator. The statement of affairs presented disclosed liabilities of £1,765; £1,040 was due to trade creditors, there were sundry creditors in respect of salaries, &c., £562, and cash deposits amounted to £163. The net assets were estimated at £671, leaving a deficiency of £1,093. Mr. Osborne stated that the cash deposits were money sent by small traders in different parts of the country for articles which they had never received. The company was incorporated in February, 1920, with a nominal capital of £6,000, divided into 5,000 ordinary shares and 1,000 employés' shares of £1 each; no employés' shares had been issued. The company took over certain plant and machinery from Mr. Chase for £858. In 1920 the company took premises in Potters Bar and spent a large sum of money in alterations, but after some 18 months it was found that serious losses had been incurred and the company was compelled to vacate the premises. In September, 1924, the company took over Mr. Hooydonk's business in Hornsey. It was decided to confirm the voluntary liquidation of the company with Mr. Osborne as liquidator, and a committee of inspection was also nominated. The following are creditors :—

	£		£
Aldenham Bros.	85	Spencer & Sons	36
Hart Mfg. Co.	31	Sankey & Sons, Ltd.	54
Lawerell Mfg. Co.	64	Standard Screw Co., Ltd. ...	20
Morgan Crucible Co., Ltd. ...	42	Smith & Co. (Clerkenwell), Ltd.	31
London Electric Wire Co. and Smiths, Ltd.	28	Walsall Mfg. Co.	144
		Chase, F.	345
Pethick Advertising Co.	252	Pethick, —	150

F. W. SMITH & Co. (1907), LTD., Manchester, electrical engineers and contractors.—A meeting of creditors was held recently at Southport. The liquidator of the company, Mr. C. Leigh, I.A., of Southport, presented a statement of affairs which showed liabilities of £2,568, of which £2,054 was due to the trade; there was a bank overdraft of £109, and the managing director's salary amounted to £405. There were net assets of £1,874, leaving a deficiency of £694. The bank overdraft was guaranteed by the managing director, and the bank also held as collateral security debenture stock amounting to £272. The company was incorporated in 1907 with a nominal capital of £5,000. The issued capital was £4,286. It was stated that the managing director's salary for the past three years had been £500, £350, and £234. The turnover in 1921 amounted to £10,081 and there was a loss of £373. From 1922 to the date of liquidation the turnover had never been more than £8,000, and no profits had been made. It was decided to confirm the appointment of the present liquidator and to appoint a committee of inspection. The following are the principal creditors :—

	£		£
General Electric Co., Ltd. ...	798	Walsall Hardware Mfg. Co., Ltd.	101
Brown Bros., Ltd.	222	Beardsall, W. E., & Co., Ltd.	69
Chloride Electrical Storage Co., Ltd.	148	Marconiphone Co., Ltd.	67
		Leigh, C.	67

W. A. SAXBY & Co., LTD., battery manufacturers, 3, Gayford Road, S.W.12.—A meeting of the creditors in this matter was held on August 20th, when Mr. Saxby stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company and receiver for the debenture holders. No statement of affairs was presented, but Mr. Saxby reported that the liabilities to trade creditors amounted to £311. In addition there were debentures for £450. Mr. Saxby stated that the debenture holders had agreed to accept 15s. in the £ in respect of their claim. The assets, after allowing for debentures and preferential claims, amounted to £119. It was stated that included in the assets was an amount of £250 representing goodwill, and although negotiations were pending for its sale, it was very doubtful whether it would fetch that amount. The company was formed in November, 1923, taking over the business previously carried on by Mr. Saxby, for £100. The nominal capital of the company was £1,000, of which £600 had been issued as fully paid. Accounts for the period of 12 months to November 15th, 1924, showed that the sales were £2,514, and there was a gross profit of £560. The expenses amounted to £849, and there was a net trading loss of £282. Mr. Saxby stated that the liquidation had been forced by the execution of a writ by one of the largest creditors. After some discussion the meeting broke up without any resolutions being passed. The voluntary liquidation of the company will, therefore, be continued with Mr. Saxby as liquidator.

ASSOCIATED ELECTRIC TRADERS, LTD.—Last day for proofs for dividend, September 2nd. Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C.

NORTHUMBERLAND AND DURHAM RADIO ENGINEERING CO., LTD.—A meeting of creditors is called for September 4th, at Atlas Chambers, 88, Westgate Road, Newcastle-on-Tyne. Liquidator, Mr. J. Mitchell.

Dissolutions of Partnership.—LUMINAUX ELECTRICAL SUPPLIES, factors of electrical supplies, 553, Mansion House Chambers, E.C.—Mr. S. G. Wallis Norton and Mr. W. Sanders have dissolved partnership.

H. DERRICOTT, general brassfounders and manufacturers of electrical fittings, Reliance Works, Penn Street, Birmingham.—Messrs. E. H. and P. W. Derricott have dissolved partnership. Mr. P. W. Derricott will attend to debts and continue the business under the same style.

DARADIO WIRELESS AND SERVICE DEPOT, London Road, St. Leonards-on-Sea.—Mr. S. W. Davies and Mr. J. E. Radermacher have dissolved partnership. Mr. Radermacher will attend to debts.

Deeds of Assignment.—T. H. JOYCE (T. & H. Joyce), electrical and wireless factors, 210B, Shaftesbury Avenue, W.C.—Particulars of claims to be sent by September 4th to the trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2.

B. E. CROW (Crow, Toogood & Co.), electrical engineer, London, Bournemouth and Eastbourne.—Particulars of claims to be sent to the trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., by September 4th.

Catalogues and Lists.—MESSRS. FARROW & SONS, LTD., Spalding, Lincs.—A stock list of new and second-hand electrical and mechanical equipment. Priced.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—A folder, illustrating the illumination of various departments of a clothing factory.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C.—List No. 2E, illustrating and describing the "Sbik" lightning arrester.

THE ELECTRIC FURNACE CO., LTD., 17, Victoria Street, S.W.1. Pamphlet D, illustrating and describing electric resistance furnaces.

MR. WALTER BALMFORD, "Electric House," Steelhouse Lane, Birmingham.—Two illustrated pamphlets, dealing respectively with radio valves and insulating staples.

THE COX-CAVENDISH ELECTRICAL CO. (1924), LTD., 105, Great Portland Street, W.1.—A pamphlet, dealing with actinotherapy or the use of artificial sunlight in healing. Illustrations and prices of apparatus are given.

THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—List 91/1, containing an illustrated description of electrical apparatus for measuring the velocity of water.

MESSRS. GEORGE GREEN & CO., 40, Aybrook Street, W.1.—An illustrated and priced booklet containing particulars of "Gee Gee" electric water-heating apparatus of various patterns.

SIR WILLIAM ARROL & CO. (SWANSEA), LTD., King's Dock Works, Swansea.—A profusely-illustrated brochure describing the company's works and some contracts which have been carried out.

MESSRS. COLE, MARCHENT & MORLEY, LTD., Bradford.—A pamphlet advertising central-exhaust steam engines.

MESSRS. LANDIS & GYR, LTD., Elgee Works, Windmill Road, Hampton Hill.—An illustrated leaflet advertising the firm's switchboard meters.

SUPERLAMP, LTD., 92 and 94, Paul Street, E.C.2.—A fully-illustrated price list of electric lighting pendants, lanterns, bowls, shades, and other fittings; domestic appliances; and signs.

Trade Announcements.—MESSRS. BREWER & PHILLIPS have opened premises as electrical engineers at 66, Regent Street, Plymouth.

BRITISH BROWN-BOVERI, LTD., states that as the result of a friendly arrangement its interest in and control of the firm of Scintilla, Ltd., completely ceased as from April 1st, 1925.

The new address of MERCHANTS & AGENCIES, LTD., is 38, Great Russell Street, W.C.1. Telephone Nos.: Museum 6634-5.

AUTOMATIC & ELECTRIC FURNACES, LTD., informs us that in order to cope with the increasing demand for "Wild-Barfield" furnaces in Birmingham it has opened branch offices in that city at 21, 22 & 40, Guildhall Buildings, Navigation Street. Mr. A. Vincent, who has been representing the company's interests abroad, is taking charge of the branch. The company is carrying out demonstrations at the Birmingham Corporation's Summer Lane generating station; the first period was from August 24th until to-day (Friday), and another is from August 31st to September 4th.

MESSRS. PHILIPS LAMPS, LTD., have opened a branch at 27, Womanby Street, Cardiff, under the management of Mr. A. H. Smith.

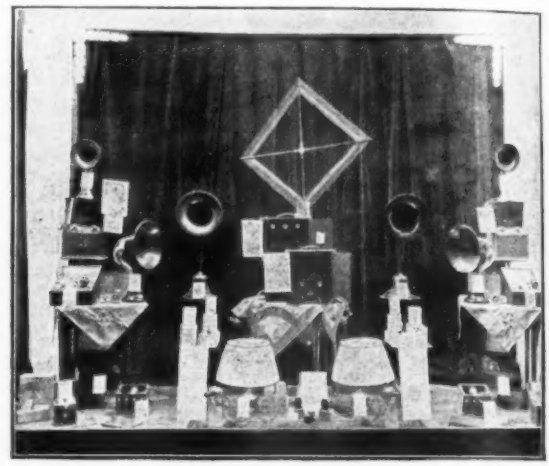
The works of MESSRS. BELLING & CO. have been transferred from Edmonton to Enfield. The new address is Bridge Works, Southbury Road, Enfield, and the telephone no. "Enfield 1123" (3 lines).

MR. E. M. PARSONS, 38a, Brook Street, Hull, electrical and radio engineer and contractor, wishes to receive catalogues of electrical and radio goods.

The Electrical Imports of Paraguay.—The *Board of Trade Journal* states that the value of electrical goods imported by Uruguay during 1924 was £18,185. Of this amount £10,078 is attributed to Argentina, £400 to the United Kingdom, £4,242 to the United States, £2,603 to Germany, and £13 to Italy.

Large American Electricity Merger.—The *Electrical World* announces that the Pennsylvania Electric Corporation is to be purchased by the Pacific Gas & Electric Co., operated by the J. G. White Management Corporation. By this transaction, which, it is reported, involves a cash payment of $20,000,000, public utility companies with combined assets exceeding $175,000,000 will be brought together, the consumers numbering about 300,000 in an area stretching from western New York through Pennsylvania and Maryland. The Associated Gas and Electric Co. controls the Manila Electric Corporation.

A B.T.-H. Display at Selfridge's.—The art of window-dressing is seen at its best at the Oxford Street premises of Messrs. Selfridge's, the outstanding feature of the windows being the specialist nature of each display. Radio apparatus made by the British Thomson-Houston Co., Ltd., has recently been dealt with by the company and the result is seen in the



A B.T.-H. Window at Selfridge's.

accompanying illustration. A few examples show the wide range of the products—frame aerial, loud speakers, receiving sets, valves, &c.—a veritable *multum in parvo*.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 19th:—

R.W. (lettering and design). No. 457,744. Class 6. Carbon brushes partly of metal, graphitic and bronze brushes, copper and brass gauze brushes, &c.—Ringdorffwerke Gesellschaft, 1, Bahnhofstrasse, Mehlen-am-Rhein, Germany. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2.)

Venner. No. 455,457. Class 8. Electrical time switches.—Venner Time Switches, Ltd.

Peter Pan. No. 458,434. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Radio Accessories, Ltd.

Bullphone. No. 459,824. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—W. Bullen, 38, Holywell Lane, E.C.2.

Rotala. No. 459,414. Class 8. Instruments and apparatus for use in telephony and telegraphy.—Rotax (Motor Accessories), Ltd.

Design of Polar Bear. No. 460,152. Class 8. Apparatus and instruments for use in connection with radio-telegraphy and telephony.—Radio Communication Co., Ltd.

Indigraph. No. 460,297. Class 8. Variable condensers and variable inductances, being parts of radio instruments.—Igranic Electric Co., Ltd.

Vacularm. No. 460,421. Class 8. Measuring and indicating instruments.—Cecil Gordon Vokes, trading as C. G. Vokes & Co., 38, Conduit Street, W.1.

Trulov. No. 460,600. Class 8. Apparatus and instruments for use in connection with radio-telegraphy and telephony.—Radio Communication Co., Ltd.

Fabrolite. No. 460,563. Class 50. Electrical insulating materials.—The British Thomson-Houston Co., Ltd.

Glasgow and the Joint Industrial Council.—The Glasgow Corporation recently received a communication from the Secretary of the Scottish District Joint Industrial Council asking if the Corporation would accept the findings of the Council and contribute to its expenses. The Corporation's Conditions of Service Committee recommends that no action be taken.

For Sale.—British Insulated & Helsby Cables, Ltd., invite offers for surplus generating plant. The Paignton Electric Light & Power Co., Ltd., will shortly be taking a bulk supply of electricity, and is therefore inviting offers for the purchase of plant at its electricity works. Plymouth Corporation Electricity Department has for disposal one 500-kW direct-coupled engine and d.c. dynamo. (See our advertisement pages to-day.)

Meter Approved.—The Electricity Commissioners have approved of the construction and pattern also the means provided for fixing and connecting meter known as the Ferranti Type "F.H." d.c. mercury motor ampere-hour meter, rated from and including 20 amp. to 100 amp., fitted with top terminals.

Social Event.—The employés of Messrs. Ferguson, Pailin, Ltd., held a sports meeting at their new ground at Belle Vue, Manchester, on August 15th. This was the first of what is hoped to be an annual series, and the abundance of athletic talent and excellent weather made the occasion a very enjoyable one.

The German Electrical Industry.—Dealing with the situation of the German electrical industry, a Frankfort newspaper states that despite the financial difficulties it has been possible for considerable progress to be made recently in the direction of the extension of the electricity supply works, which has naturally brought orders to the manufacturing industry. In individual cases (the Saxony works, the Mark works, &c.), the financing of the developments has been effected by the raising of loans, but in most cases the cost of the expansion has been defrayed out of the current income of the municipal and State works resulting from the present high charges for the supply of energy. This development has caused the manufacturing industry on the whole to have a good turnover and in most cases has ensured full activity. On the other hand, the foreign trade has considerably declined because German export prices are higher than those of foreign competitors, although there are certain articles in which individual works are claimed to surpass foreign firms, and technical developments will soon, it is said, again result in these articles coming on the export market. After these general observations the Frankfort newspaper proceeds to discuss the situation of the electrical manufacturing industry in the Frankfort district. Among the branches mentioned are the production of switchgear and switchboards, installation material, measuring instruments, heating installations and appliances, electromedical apparatus, telephones, telegraphs, clocks, &c. Summarising the situation it is submitted that the Frankfort electrical branches are not badly occupied, but in part are well employed, although the export trade leaves much to be desired. The financial position is not easy, but is said to be certainly better in many cases than in other branches of business.

South American Rubber.—According to the *Board of Trade Journal* the exports of Para rubber from Para, Manaos, and Iquitos during the first half of the current year, amounted to 13,345,000 kg., of which 7,753,000 kg. went to the United States and 5,449,000 kg. to Europe. The British Consul at Iquitos informs the Department of Overseas Trade that the improved prices for rubber have led to merchants in the district taking a renewed interest in the extraction of the latex. Most of the rubber trees have not been tapped for seven years, and it is anticipated that they will give an exceptional yield.

Australian Preference Conditions.—In the Australian House of Representatives, on August 21st, Mr. Pratten, Minister of Trade and Customs, introduced the Customs Act Amendment legalising the imposition of a condition that goods, in order to enjoy full preference, must be 75 per cent. of British manufacture.—*Reuter* (Melbourne).

Irish Free State Electrical Imports.—The value of the imports of electrical goods into the Irish Free State during May last is officially returned at £35,647—a decrease of £8,336, as compared with May, 1924, bringing the total for the first five months of the year to only £134,836, as compared with £189,776 in the corresponding period of 1924.

Copper, Lead and Rubber Prices.—Messrs. F. Smith & Co. report August 25th:—Copper (electrolytic) bars, £69 15s., £2 increase; do. do. sheets, no change; do. do. wire rods, £78 10s., 15s. increase; do. do. h.c. wire, 9¼d., ½d. increase.

Messrs. James & Shakespeare report August 25th:—No change in the prices for copper bars (best selected), sheet and rod; English pig lead, £40 10s., 30s. increase.

Messrs. Edward Till & Co. report August 25th:—Indiarubber, Para, fine, 3s. 1d., 1d. decrease.

New Municipal Showrooms.—The Warrington Corporation is to establish separate municipal showrooms for the Electricity and the Gas Departments, both of which will be situated in Horsemarket Street. There was some criticism of these proposals at the last meeting of the Town Council, one of the main arguments being that there should be a combined showroom for both departments. The chairman of the Electricity Committee (Sir Peter Peacock) said that the Electricity Committee had been looking out for premises for the last four years.

Chinese Tariff Conference.—The Chinese Government has forwarded to the Powers an invitation to attend a special tariff Conference in Peking in accordance with the Nine Power Washington Treaty. The date of the Conference is to be October 26th. The invitation expresses China's desire to convene a conference in accordance with the provisions of the Treaty, at the same time reminding the Powers that her right to bring up the question of tariff autonomy at an opportune moment was reserved by the Chinese delegates at the Washington Conference.—*Reuter* (Peking).

Lighting and Power Notes.

Ampthill. — ELECTRICITY SUPPLY. — The Urban District Council has given its consent to the application of the Bedford Town Council for a Special Order to supply electricity to the town.

Barnsley.—MAINS EXTENSIONS.—The Electricity Committee is to carry out mains extensions at a cost of £5,230.

Bristol.—YEAR'S WORKING.—We have received from Mr. H. Faraday Proctor, city electrical engineer, his annual report and the statement of accounts of the electricity undertaking for the year ended March 31st last. The total revenue was £421,011, as compared with £370,906 in the preceding year. Working expenditure increased from £216,886 to £252,014, leaving a gross profit of £168,997, as against £154,020, to which was added a sum of £14,059, being adjustment of income tax, and £262 from the obsolescence reserve fund, making a total of £183,317. Capital charges absorbed £112,633, leaving a net surplus of £70,685, as compared with £67,809 in the preceding year. Of the surplus £16,000 was contributed to the district rate, and the remainder transferred to reserve. The net capital expenditure during the year amounted to £121,115, and included £72,295 for mains. The sales of electrical energy amounted to 56,082,891 kWh, an increase of 5,957,411 kWh, and the average price per kWh obtained fell from 1.67d. to 1.64d. The maximum supply demand rose from 23,107 to 26,345 kVA. The number of electric cookers connected during the year increased from 112 to 451, and an additional 41 miles of cable was laid. The change-over of the system of supply in the Fishponds and Brislington districts was completed, and good progress was made in the Clifton, Horfield, and Knowle districts.

Burnley.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. J. E. Starkie) for the year ended March 31st last shows a total income of £87,426, as compared with £85,708 in 1923-24. The working expenditure was £41,222, as against £40,118, and expenditure incurred in respect of plans for a new station—which have been rejected by the Electricity Commissioners—charged to revenue, amounted to £801, leaving a gross profit of £45,401 (£45,590). Capital charges absorbed £25,544, leaving a net surplus of £19,857, as compared with £19,895 in the preceding year. Of this amount £6,000 was transferred to depreciation and meters extension account, and the remainder to reserve. The capital expenditure during the year amounted to £24,773, the chief item being £17,514 for mains and services. The electrical energy sold increased from 8,068,242 to 8,223,508 kWh, and the maximum supply demanded from 3,770 to 3,900 kW. During the year application was made to the Commissioners for sanction to install two 5,000-kW turbo-alternators to meet the estimated increased demand during the winter of 1926-27.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Electrical News*, work is to commence on the erection of a hydro-electric power station, on a site at Grand Falls, recently acquired by the province of New Brunswick. Plant with a capacity of from 50,000 to 60,000 h.p. will be installed at first, and additional plant of 25,000 h.p. added later. The ultimate development of the site is placed at 150,000 h.p. The Premier of the province has announced that already the Government has received demands aggregating 71,000 h.p. from paper mills in the province.

Cannock.—EXTENSION OF SUPPLY.—In connection with the proposal to supply electricity to Cheslyn Hay and Great Wyrley, the U.D.C. proposes to extend the mains and provide the necessary sub-stations at an estimated cost of £20,785, and is applying for assistance to the Unemployment Grants Committee.

Chester.—SPECIAL ORDER.—The Corporation has applied for a Special Order, for the supply of electricity in the urban district of Tarporley, and in certain parishes in the rural district of Tarvin.

Continental.—ITALY.—The Società Elettrica del Valdarno and the Società Ligure Toscana di Elettricita are erecting a new 120,000-V transmission line between Florence and Leghorn, a distance of about 47 miles. The line will be carried on ferro-concrete masts 69 ft. high.

JUGO-SLAVIA.—According to a recent official report the water-power resources of Jugo-Slavia represent a total of 2,982,922 h.p., divided as follows:—Serbia, 1,265,568 h.p., Bosnia-Herzegovina, 621,141 h.p., Slovenia, 260,308 h.p., Montenegro 280,098 h.p., Croatia and Slavonia 365,836 h.p., Dalmatia 59,700 h.p., and Woimoden 159,280 h.p. The foregoing figures refer to the power available at low water level, the power being on the average three to four times greater. So far only 7,529 h.p. is being utilised in Serbia, 11,330 h.p. in Bosnia-Herzegovina, 70,836 h.p. in Slovenia, and 60,600 h.p. in Dalmatia. Among the new plants at present under consideration are one of 24,000 h.p. on the River Sare, one of 100,000 h.p. in the Velebite Mountains in Croatia, and one of 100,000 h.p. on the Dwina in Bosnia.

CZECHO-SLOVAKIA.—A recent issue of the *Journal* of the Czecho-Slovakian Ministry of Public Works states that there are now four hydro-electric stations of a total of 7,270 h.p. in operation in the country, *viz.*, on the Elbe, near Konighof (2,100 h.p.), on the Morava, near Kromeric (2,130 h.p.), on the Elbe, near Podebrad (1,300 h.p.), and one on the same river near Nimburg (1,740 h.p.). Five additional plants of a total of 10,740 h.p. are in course of construction, and ten other hydro-electric power stations of a total of 101,070 h.p. are projected. The bulk of the electrical energy will be utilised in the Ostrau coal-mining area.

Eastbourne.—INQUIRY.—An inquiry was held at the Town Hall on August 14th by Sir William Marwood, on behalf of the Ministry of Transport, into the application of the Corporation for sanction to supply electricity to Willingdon. Mr. H. Caldwell, for the Rural District Council, raised objection to the use of overhead lines. Mr. Brydges, borough electrical engineer, stated that the only way to provide electricity at a reasonable price in that neighbourhood was by means of overhead wires. Sir William Marwood will submit his report to the Ministry in due course.

Glasgow.—Year's Working.—We have received a copy of the 33rd annual report of the Corporation electricity undertaking (engineer: Mr. R. B. Mitchell) covering the year ended May 31st last. The revenue account shows an increase of income from all sources of £88,925, and working expenditure an increase of £80,315, the former from £1,153,194 to £1,242,119, and the latter from £571,119 to £651,434. The gross profit was thus £590,685, as against £582,075. Interest on loans amounted to £244,361, sinking fund charges to £235,961, and depreciation £98,590, leaving a net surplus on the year's operations of £11,772, as compared with £5,975 in the preceding year. This was transferred to the reserve fund, which now amounts to £88,349. The increase in the working costs is attributed to a large increase in respect of rates and taxes, and to the general increase in the repairs, and maintenance of buildings, plant, &c. The capital expenditure during the year amounted to £416,867, bringing the total expended on the undertaking up to £7,386,749. The chief items of expenditure were £78,554 for additions to Dalmarnock station and £141,826 for mains and cables. The electrical energy sold increased from 166,087,836 to 179,263,199 kWh, of which 8,181,500 kWh was generated at Port Dundas and the remainder at Dalmarnock. The average gross income per kWh sold was 1.663d., as compared with 1.666d. in 1923-24, and the cost per kWh sold 1.647d., as against 1.657d. The maximum supply demanded rose from 193,214 to 211,003 kW.

In connection with the Dalmarnock station, the report states that the building extensions to the turbine room, boiler-house, and switch house are nearing completion. The erection of the first of two 25,000-kW sets on order from Messrs. C. A. Parsons and Co. will commence early in September, and the set is expected to be in commission by December this year. The switchgear on order from Messrs. A. Reyrolle & Co., Ltd., is well advanced, and will, in all probability, be ready to take load by the end of November. During the year five additional substations were put into commission, and construction was commenced on three others.

Lymm.—Inauguration of Supply.—The new sub-station at Eagle Brow was opened on August 12th by the chairman of the Urban District Council. In December, 1923, the Council approached Warrington Corporation for a supply of electricity, and satisfactory terms were arranged. Electricity is generated at the Warrington Corporation electricity works and transmitted to the Lymm sub-station through duplicate feeders at 6,600 V, 3-phase, 50 cycles, where it is reduced for distribution. Two oil-cooled transformers of 150 kW each are at present installed. The h.p. switchgear was supplied by the British Thomson-Houston Co., Ltd., and the transformers by the Fuller Electrical & Manufacturing Co. British Insulated and Helsby Cables, Ltd., supplied the h.p. cables, and W. T. Glover & Co., Ltd., the l.p. cables. The scheme was designed and carried out under the supervision of the borough electrical engineer, Mr. F. V. L. Matthias.

Market Drayton.—Street Lighting.—The Urban District Council has accepted the offer of the Market Drayton Electric Light & Power Co., Ltd., for public lighting, from September 13th next to April 17th, 1926, at £3 10s. per lamp.

Northallerton. — Street Lighting. — The Urban District Council has accepted the tender of the Northallerton Electric Light & Power Co., Ltd., for public lighting for a period of two years.

Perth.—Electricity Charges.—A reduction of 5 per cent. in the lighting and power rates for electricity was sanctioned at the last meeting of the Town Council.

Pontypool.—Electricity Charges.—The Pontypool Electric Light & Power Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to revise the maximum electricity charges in the district.

Presteign.—Street Lighting.—The Urban District Council has accepted the offer of the Presteign Electric Co., Ltd., for street lighting during the period September 29th to March 31st next, at £2 per lamp.

Shelf.—Electricity Supply.—The Urban District Council is to support the application of the Electrical Distribution of Yorkshire, Ltd., for a Special Order authorising it to supply electricity within the urban district.

Southend-on-Sea.—Loans.—The Town Council is applying for sanction to the following loans:—£4,041, balance for the installation of one 750-kW Diesel engine at London Road station, and two similar engines at Leigh station; £3,059 for three waste-heat boilers, with piping, valves, &c., and the extension of the cooler room at Leigh station.

Southwell.—Electricity for Villages.—The Rural District Council has decided to ask the Derbyshire and Nottinghamshire Electric Power Co., which is about to carry overhead cables through a portion of the rural district from Farnsfield to Aversham, whether it will be willing to supply the various villages *en route* with electricity.

Spalding.—Electricity Scheme Delayed.—The electricity scheme is being held up by the Electricity Commissioners, who are urging the Urban District Council to take a supply in bulk from either Boston or Peterborough. The Council maintains that it will be cheaper to have its own generating station.

Taunton.—Loans.—The Town Council has applied for sanction to loans amounting to £7,000 for the following purposes:—Mains, £5,000; meters, £1,500; motors, £500.

United States.—Electrical Development.—According to *Power*, the Public Service Company of Northern Illinois has recently ordered a 50,000-kW steam-turbine for the Waukegan Station. This is the third set, the first being one of 25,000 kW, which was installed two or three years ago, and the second of 35,000 kW, installed last winter.

The *Electrical World* states that the Buffalo General Electric Co. has received a contract from the city of Buffalo to replace with electric lamps all the existing gas lamps of that municipality. The new contract runs for two years from the beginning of 1926 with the option of a renewal for another year. Equipment for the business streets will consist of 4-amp. and 6.6-amp. inverted magnetite lamps, and residential street illumination will be by incandescent lamps of from 100 c.p. to 150 c.p., with underground conduits. These will be of the same type as those which have already been installed in residential streets by the company to the number of about 2,000.

Wick.—Electricity Scheme.—The Town Council has decided to proceed with an electric lighting scheme for the borough.

Wimborne. — Electricity Supply. — The Urban District Council proposes to consent to the application of Torr, Dunnford & Co. for a Special Order to supply electricity to the town, subject to the maximum price of 1s. per kWh being reduced when the shareholders have received a dividend of 8 per cent.

Wirral.—Electricity Scheme.—At a recent special meeting of the Rural District Council it was decided to ask for tenders for the laying of cables for the first two sections of the work from the boundary of Ellesmere Port to the parish of Heswall, *via* Neston, and the second section from Wallasey to Moreton. Powers to borrow £110,000 for the work have been applied for by the Council.

Tramway and Railway Notes.

Argentina.—Buenos Aires.—The Anglo-Argentine Tramways Co.'s scheme has been accepted by the Municipal Executive. The company's proposals provide for the taking up of surface lines in a small congested area, but the rights to run traffic over these roads are to be retained. In addition, subways are to be constructed and omnibus services to be established in the suburban areas. The 'buses will run in connection with the tramways and subways. The whole programme will probably require 120,000,000 dol. paper, and will take a number of years to complete.—*The Electric Railway and Tramway Journal.*

Birkenhead.—Motor Omnibuses.—The Tramways Committee has decided to substitute motor omnibuses for tramcars on one of the routes.

Bury-Salford. — Through-Running.—A scheme for a through-running tramway service between the two towns is under consideration.

Dover.—Loan.—The Corporation is applying for sanction to a loan of £7,184 for track renewals.

Ipswich.—Railless Cars.—According to *Modern Transport*, the Corporation has now been granted powers to run railless cars over the whole of its existing tramway system. The application for Parliamentary powers to effect this alteration was made on the recommendation of Mr. A. Baker, general manager, Birmingham Corporation Tramways, who undertook the examination of the matter at the request of the Corporation, and decided that the existing tramways were worn out.

Lochgelly.—Tramway Scheme.—According to the *Electric Railway and Tramway Journal*, the Town Council has finally agreed to withdraw its opposition to the Provisional Order for the extension of the Fife electric tramway through Lochgelly eastwards. The proposed new line branches off the present line at the Cross, and continues eastward along East Main Street, across the foot of High Street, and through the Public Park on the south side of the Lochgelly Iron and Coal Co.'s Jenny Gray colliery.

London.—Old Street Station Improvements.—Escalators were put into service at Old Street underground station on August 19th. A basement booking hall, with passimeters, is being formed, whilst the station building will be replaced by one of modern Underground design, shops being a feature.

Progress of "Underground" Extensions.—According to *The Times*, excellent progress is being made with the work of extending the City and South London Railway to Morden. The tunnelling is now completed, and the engineers who will lay the track are about to take charge of the operations. The new rolling stock is being delivered. It is not expected, however, that the line will be open for traffic until early next year. The two-mile extension of the Kennington loop, which runs from Charing Cross to Kennington, via Waterloo, is making progress. Work is being carried out from four working shafts, with service headings. From the Charing Cross shaft the south-bound station tunnel is under construction, and two-thirds is now complete. On the north-bound line, tunnelling is going on under the river bed, over 50 yards having already been completed. This tunnel will make a junction with the north-bound station tunnel at Kennington, and in the south-bound tunnel a junction will be effected midway between Bethlem Hospital and Kennington station.

Breakdown.—A temporary breakdown of the electric train services between Broad Street and Richmond on the London, Midland and Scottish Railway occurred on August 19th. Steam trains to Richmond were put into operation at Broad Street, and these enabled the passengers to travel to their destinations with only about half an hour's delay.

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A Large Electric Cable and Accessories Works.

A Visit to the Prescot Works of The British Insulated & Helsby Cables, Ltd.

THE extensive works at Prescot of The British Insulated and Helsby Cables, Ltd., to which we recently paid a visit, and which at present occupy a factory space of some thirty acres, excluding extensions which are at present being carried out, were established originally by the British Insulated Wire Co. about 1888, the works then covering about two acres. The first products were small single wires and cables for lighting work, paper insulated and lead covered, and multiple twin conductors for telephone work. In 1902 an amalgamation was effected with the Telegraph Manufacturing Co., Ltd., of Helsby, resulting in the formation of The British Insulated and Helsby Cables, Ltd., of which Mr. James Taylor is the chairman and Mr. Dane Sinclair the general manager.

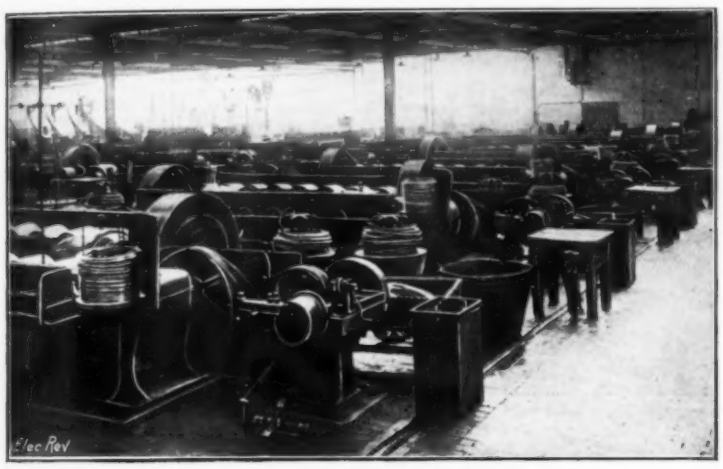

Fig. 1.—Automatic Wire Drawing Machines.

The works are favourably situated, with the main Liverpool to Warrington Road bordering them on the north side and the extensive sidings of the L.M.S. Railway on the east. A double track connects these sidings and the works, running through a central avenue of loading and unloading yards and sheds from which the various departments radiate. The principal manufactures of the works are, of course, copper wire and rod, &c., and paper-insulated cables of every description; but the accessories branch is by no means a small one, covering an area of about 12 acres; cable boxes, pillars, switches, fuses, and bonds are but a few of the products.

In a tour of the works, which is no light task in limited time, the first place of interest, taking the cable-making departments in the order of manufacturing process, is, curiously enough, also the last, being the copper refinery, where the scrap metal collected from the various departments is dealt with. The copper is melted down in oil furnaces and moulded into billets about 2 ft. long by 3½ in. in diameter. These, with bulk supplies from outside sources, are dispatched to the rolling mills, where they are reduced to ¼-in. rod. There are at present three rolling mills, two being used for aluminium rod and sheet; but a fourth mill is being equipped for copper rod rolling, this being 210 ft. long by 70 ft. wide. Each copper-rod mill is equipped with a reheating furnace and three sets of rolls. After rolling, the copper rod carries a black oxide scale which is removed by immersion in weak acid. This is done in long pickling tanks. The next process of importance is the wire drawing, the bulk of which is effected in a new and well-equipped shop, 240 ft. by 156 ft., but the very fine wires are dealt with in two smaller rooms after being reduced to about No. 16 gauge in the first-mentioned shop. Two methods of drawing are carried out, on automatic and single block machines; wires for special uses and contracts are dealt with on the latter. Fig. 1 is a view of some of the automatic machines, and fig. 2 shows the single block drawers. The rod is first reduced through nine dies to No. 16 gauge and then through a further ten dies to No. 25 gauge. These dies are of chilled cast iron and are made at the B.I. & H. works. From No. 25 gauge the wire is drawn on the fine-wire drawing machines in the smaller shops through 16 or more diamond dies to reduce it to the smallest size, one mil diameter. In the final stage of drawing, the wires are hard. For the process of cable making it is necessary to anneal the wires; this is done in the annealing department, fig. 3, where the wires are passed through Bates & Peard bright annealing furnaces. In the chambers of these furnaces is a steam pressure slightly above that of atmosphere. Each chamber is air-tight, and the openings through which the wires enter and leave are water-sealed. Most of the machines in the

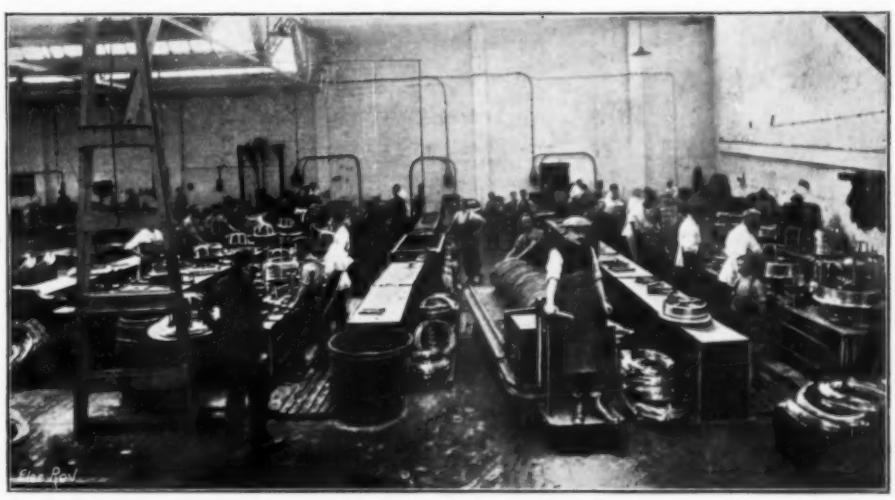

Fig. 2.—Wire Drawing Blocks.

wire mills are driven singly by electric motors, 4,100 h.p. of which are installed in the rolling and wire mills.

The extruding department is one of particular interest and importance. Here the metal, instead of being rolled, is extruded through dies in a semi-molten condition. Fig. 5 is a view of the extruding department; the heavy wire-drawing machines are shown in the foreground, and it is on these machines that grooved contact wire for traction work is drawn, forged steel dies being used. Much heavier work, such as bus-bars, &c., is dealt with on draw benches, on which the bars, &c., are carried along after extrusion on chain travellers. Some American metal presses, which also play an important part, were installed for munition-making purposes during the war. Aluminium sections, angle channels, beading, &c., are also products of the extruding department, which is served by a 5-ton Heywood crane.

Fig. 3.—The Annealing Department.

At this stage of the cable-making process it is interesting to note that the output of copper exceeds 100 tons per day. All the wire for the B.I. & H. rubber-covered cable works at Helsby is manufactured at Prescot. This wire, in order to prevent action on the copper by the sulphur in the rubber, is tinned by passing it through baths of flux and molten metal. To comply with the B.E.S.A. specifications, all hard-drawn wires are subjected to the usual wrap and twist tests in the shops, and tests for elongation, conductivity, &c., in a fully-equipped testing laboratory.

It is necessary in many cases to produce longer lengths of wire than are turned out by the machines, and to meet these requirements electrical butt-welding machines of the firm's own design and make are installed in the wire-drawing shops.

The extensive rooms of the wire-stranding department make the next call on the metal. Stranding machines for all sizes of cable are installed, including those of the rotating-bobbin type, and others of more modern design in which the bobbins float in line with the cable. The stranded cores are now dealt with in the paper-covering rooms. Here, the paper, which is received in rolls 24 in. wide, is cut into strips of about 1 in. in width and wound on reels on paper-cutting machines, each machine dealing with a complete roll in one operation. The wound reels are installed on the paper-covering machines, which transfer the paper to the cable cores. These machines are of the tandem type, and some of the larger machines wind 40 layers of paper in one operation. The paper used for the insulation of the "outers" of concentric cables, not the overall insulation of other cables, is impregnated before application—in all other cases the cores are covered with dry paper. The cores are papered separately, after which they are built up on very large covering machines which twist the cores, run the spun yarn into the spaces between them, and apply the outer or overall insulation.

Samples of the paper received are analysed in the chemical laboratory to ensure that they contain no matter which will prove injurious to the metal, or to the paper itself in the course of time; also to ensure that it is of sufficient strength to run on the machinery. It is of importance that the paper should be able to withstand the temperatures to which it is subjected in the drying ovens, where it is treated after being applied to the cable, and again in the process of impregnation. The paper must have a certain limit of porosity sufficient to allow the impregnating oils to penetrate, but not sufficient to permit them to flow away. It is interesting to note that one function of the paper is to hold the oils in thin layers, it being a peculiar property of oil that it is stronger (electrically) in films than in bulk. The main insulating room is served by two cranes of 15- and 5-ton capacities. Insulating is also effected in two other rooms, one of which is mostly devoted to stranding. These departments, with the two long lead rooms and the general office block, occupy the south-east corner of the works. The impregnating plant is part of the equipment of the lead rooms, thus enabling the lead covering to be applied directly the cables leave the ovens, and cranes are provided for the quick transportation of the cables, the large room being spanned by a 15-ton and a 10-ton cranes, and the small room by a 15-ton and a 5-ton cranes.

Fig. 4.—The Braiding Shop.

When ready for lead covering, the cables are suspended (on the factory drums) in oil tanks; they are then unwound and passed through the lead-covering machines. These are of the usual type, in which the moulds receive the molten lead from overhead furnaces,

and apply it to the cable running horizontally through the centres; it might be more accurate to say that the lead is formed round the cable as, of course, any consideration of forcing the lead on to the cable is out of the question. Unless an alloy sheath is specified, pure virgin lead is used for sheathing.

The process, after testing, takes us to the armouring shop. This is a large room, 520 ft. long by 100 ft. wide, at the west extremity of the existing works, covered by a 15-ton crane. Two types of machines are installed, those for wire armouring and those for tape armouring. The former are similar in design and principle to those used for the core stranding, and the latter operate on similar lines to the paper-covering machines. A heavy machine arranged along the centre of the department is the outstanding feature; at the time of our visit it was dealing with a 0.25-sq. in., 3-core, 33,000-V cable for the City of London. A view of this shop is shown in fig. 6. A new building of steel and glass construction throughout is at present being erected for this department.

On this machine and other smaller ones the whole operation in connection with the armouring of the cables is effected. The lead is compounded at one end, and the cable is finally whitewashed at the other extremity, the covering of jute, cotton, or hessian tape, &c., over the lead, the winding-on of the armouring, and the final covering of jute, being done in order along the machine between these points. Welding machines serve a very useful purpose in this branch of the works for joining the lengths of wire and tape used for armouring. The railway track runs past the south end of this building, and across the lines is the drumyard, from whence the drums are transported to a distributing field on the opposite side of a by-road. A 5-ton "Goliath" crane, which runs on rails 80 ft. apart and has an effective span of 100 ft., serves the yard and field: it is electrically driven, the supply being collected from overhead wires run out on wooden poles. This crane is a recent addition, and its usefulness can be gauged by the large distributing area over which it operates.

All finished cables are dealt with in a fully-equipped cable-testing department adjacent to the armouring shop. This building, 240 ft. by 100 ft., is served by a 15-ton crane and is provided with three large immersion tanks in the centre. The actual testing operations are carried out at the sides. Three testing bays for pressure testing are arranged on one side of the test house, and a gallery above the bays is equipped with the necessary measuring apparatus. Each bay is used and equipped for testing up to a given pressure, the maximum pressures being 10,000, 50,000, and 200,000 V; the bay for the last-named is used also for h.p. experimental work. Included in the testing plant are two Mordey-Victoria 2,000-V alternators, relics of the original Prescot lighting scheme, still rendering good service. A 600-kVA G.E.C. (America) machine supplies the pressure-raising transformers at 1,000 V. For applying some of the lower pressures, an adjustable double coil is used in which the pressure is raised by balancing inductance against the capacitance of the circuit. All pressure tests are applied for 15 minutes or more.

The manufacture of telephone cables is carried out in its entirety as a separate branch in two buildings to the south of the works, one being 400 ft. long by 100 ft. wide, and the other about two-thirds of this size.

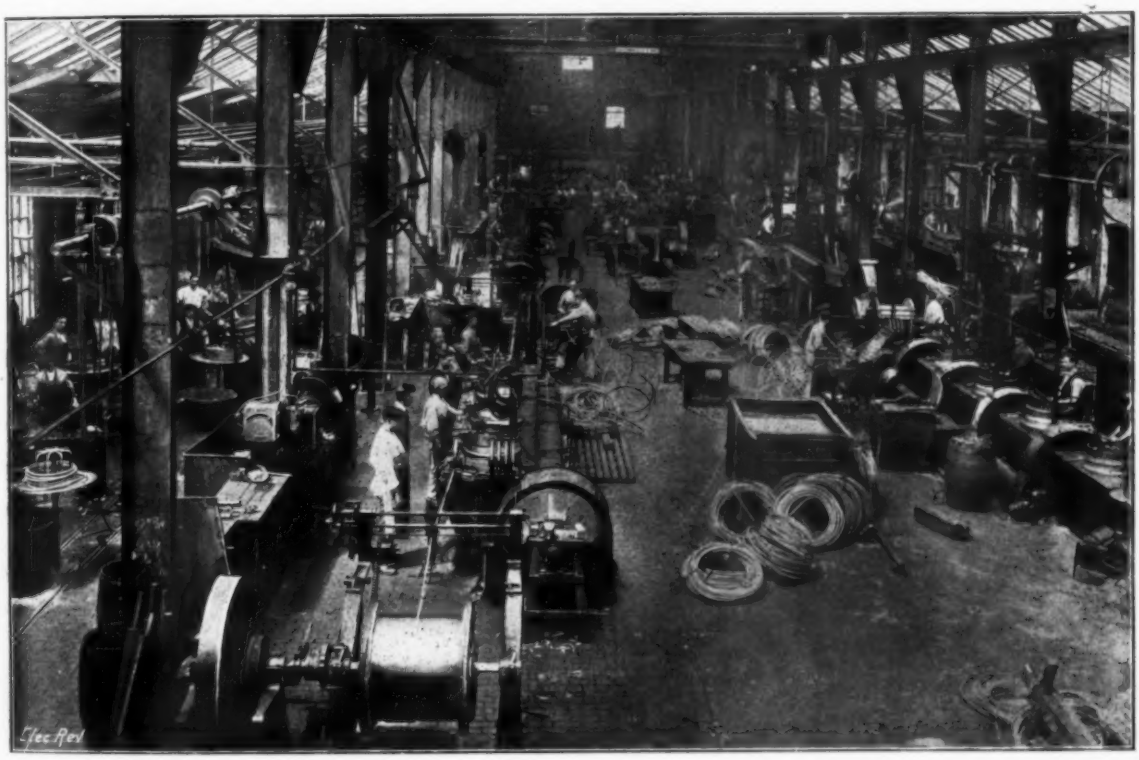

Fig. 5.—The Extruding Department.

The former is served by a 5-ton crane, and deals with the manufacture up to the lead-covering process which is carried out in the smaller house, also equipped for testing the cables; two cranes—10-ton and 7-ton—span this shop. Paper-lapping machines for covering the bare copper strands are of the revolving-bobbin type. The twinning of the paper-wound strands is carried out on horizontal and vertical machines. For multiple cables the process is carried out on special-precision twinning machines designed to ensure that the lengths being twinned are exactly equal in order to obtain the balance of capacities vital in telephone work. A most interesting feature of this department is a long cabling machine which will build up 165 pairs of wire in one operation. This machine is of the revolving bobbin type, and is made up of 10 fliers, each of which deals with one layer of wires or pairs of wires, each successive flier holding the larger number of bobbins required for the increased size of the concentric layer. Several machines of this type are installed in the department, and cables built up to certain sizes on some of the machines are transferred to others to be further increased. Cables consisting of 1,350 pairs of 6½-lb. wire have been built on these machines. All cables are tested for con-

tinuity before transportation to the lead-covering rooms. The braiding of aerial cable is effected on 24-bobbin machines. Fig. 4 is a view of the braiding shop; it will be seen that the cables are unwound and rewound, before and after braiding, on drums under the platform on which the machines are mounted. Special cables for hot and dry climates are dealt with on these machines. The cotton-covering shop is situated adjacent to the braiding room, and is equipped with cotton-whipping machines of several types, including some of the high-speed central bobbin type. The production of enamelled wire is carried out extensively, and it is interesting to note that 270,000 miles of this material were sold last year in sizes up to 0.052 sq. in.

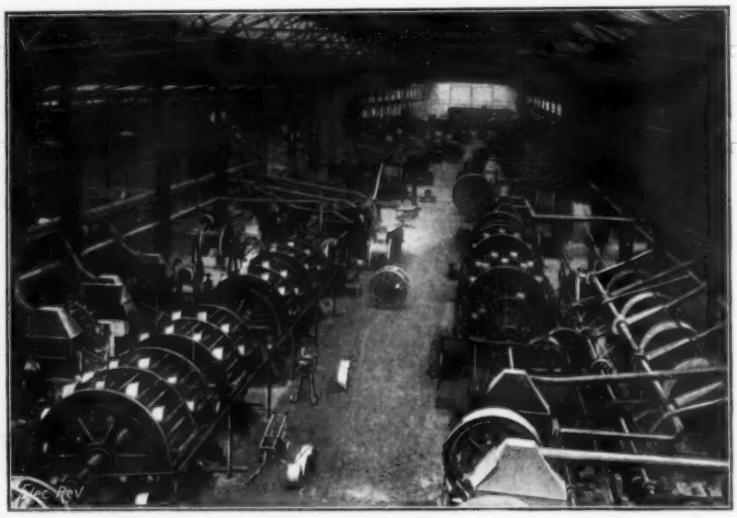

Fig. 6.—The Armouring Shop.

The accessories department is by no means a small branch of the works, and occupies an area of about 12 acres at the N.E. corner. It is a factory within a factory, and employs something like 1,200 hands. Electrical equipment of every description is manufactured, including cable boxes and pillars, insulators, bonds, meters, fans, welders, &c. Two large foundries form a considerable part of this department, and turn out castings for the various products. The machine shop is of particular interest; here electrical welders are made for butt, seam, and resistance welding in many varieties of work. These machines are of B.I. & H. production, including some of the firm's own design. The company has been making electric welders for the last 23 years, and at present it is turning out over 80 different types.

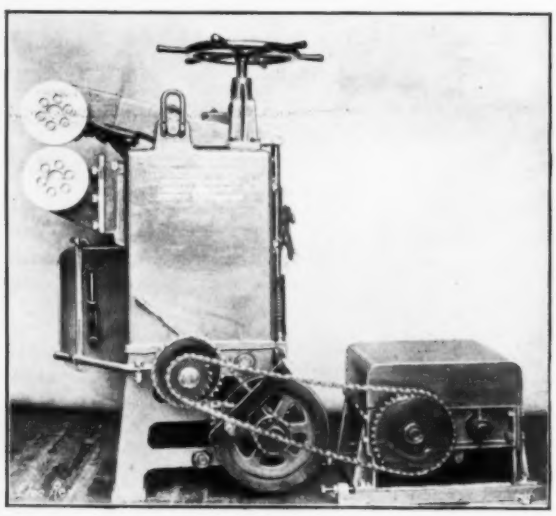

Fig. 7.—An Electric Seam Welder.

Fig. 7 shows a seam welder, one of the latest productions of the firm. Bond making is carried out on a large scale, the output being somewhere in the region of 10,000 bonds per week. A special bond of the firm's own design, of the protected type, is of particular interest; it is intended for railway work, and is constructed on an oval frame; it consists of a continuous strip of copper, making several layers. The terminals are cold pressed on to the ends of the strip to remove any air which may be locked in before being forged. Twenty-one fires used for casting the heads for bonding are installed in the bond-making shop; also four new compressed-air moulding machines, besides numerous presses of every description.

The machinery of the meter-manufacturing shops presents a contrast to that of the cable-making and accessories departments. Tiny lathes are at work on the very delicate parts for electric meters, and modern American automatic pinion cutters and wheel-cutting machines are among the latest additions to the equipment. The production of electric fans is a further interesting engagement of this part of the works, and special fans for use in hot climates are turned out by mass production.

A fleet of 21 electric battery trucks is engaged on transportation duties in and between the various shops and departments throughout the works. These are mostly of the elevating-platform type, and are each of 2-ton capacity. The batteries for these vehicles are charged at a special station equipped with three panels, each capable of dealing with five trucks at a time. A supply is received at 120 V d.c., and is equalised out at 40 V to each panel by a balancing set. One of the trucks is shown in fig. 8, which also gives a view of an electric 1-ton runway. This serves all the shops

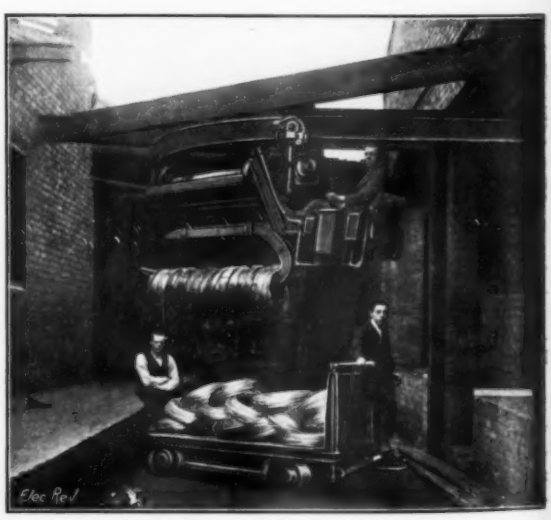

Fig. 8.—Electric Truck and Runway.

of the wire-mill department, except the extruding room. It will be seen that with the coils of wire placed together in a vertical plane the horizontal carrying arm can thread several in a single operation.

Practically the whole of the machinery throughout the factory is electrically driven, and the supply is received from the firm's own 5,500-kW capacity generating station situated on the site, supplemented by a supply in bulk from the Liverpool Corporation. The demand of the factory is in the neighbourhood

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of 9,000 h.p., but the station also supplies the town of Prescot. The generation is 3-phase a.c., but most of the factory is equipped with d.c. motors, the necessary conversion being done in a rotary station put down by the company. The general offices face the railway at the front of the works; they occupy a floor area of 25,000 sq. ft. The departmental offices are arranged on the sites of the departments.

The welfare of the staff and workpeople is by no means neglected. A large and well-equipped canteen, built in 1915, affords accommodation for those of the staff and workpeople who live at a distance from the works. Four dining rooms are provided for the use of the male and female staffs and factory workers. Meals are supplied at very reasonable prices, and those workers who bring their own meals can have them warmed up; gas, steam, and electricity are used impartially for the cooking and heating apparatus. Rest rooms are provided for the female employés, and attached to these is a sewing room where overalls are turned out for use in the works. A trained ambulance staff is constantly in attendance at the ambulance rooms; these are situated in the centre of the works. Adjoining the ambulance station is a room fitted with X-ray apparatus to deal with any casualties requiring such attention. The latest development is a dental clinic where employés can obtain first-class treatment at reduced charges.

Telegraph and Telephone Notes.

Czecho-Slovakia.—TELEGRAPH SERVICE.—According to the annual report for 1924 of the Czecho-Slovakian Post and Telegraph Department, there are now 3,631 telegraph offices and 84,830 miles of telegraph wire in use in that country, the number of messages handled last year having been 15,800,000.

Faroe Islands.—RADIO-TELEPHONY.—New facilities for intercommunication between islands in the Faroe group have been provided by the installation of two small duplex wireless telephone sets on the islands of Thorshaven and Nolso. The apparatus, which is of the Marconi XP1a type, does not need the attention of a skilled operator, being used in the same way as an ordinary house telephone. The set comprises a small power valve transmitter and a valve receiver, worked entirely from batteries, and with the aerial supported by masts 70 ft. in height, communication over a distance of 20 miles can be maintained. The adaptability of this Marconi equipment to a variety of circumstances is shown by the fact that apparatus of the XP1 type has been supplied to the State railways of Siam for use in connection with that service.

France.—CALL DISK COMPETITION.—The French Post and Telegraph authorities are organising a competition for the most suitable pattern of official call disk for subscribers of automatic telephones. Subscribers must submit their designs before October 15th next. Full particulars of the competition can be obtained from the Direction de l'Exploitation Telephonique, 4me Bureau, 103, Rue de Grenelle, Paris.

Germany.—NEW ATLANTIC CABLE.—The submarine telegraph cable which the Deutsch Atlantische Telegraphengesellschaft is to lay from Emden to the Azores, to connect with the Commercial Cable Co.'s and the Western Union's systems, has been ordered from the Norddeutschen Seekabelwerken A.G. in Nordeeham, says the *Financial Times*, and is to be ready in the autumn of 1926.

Japan.—NEW RADIO COMPANY.—A Japanese wireless telegraph company, managed jointly by the private interests concerned and the Government, has come into being with Viscount Shibusawa and Baron K. Nakashima as members of the committee. The company is to be organised with the Government station at Iwaki as its principal asset, reports the *Daily Telegraph*. Supplementary subscriptions in shares will be made by prominent business interests in Japan.

NEW RADIO SERVICE.—A new wireless telegraph service to Japan has been inaugurated by Marconi's Wireless Telegraph Co., Ltd., and is now available to the public. The rate is 3s. 4d. per word, and messages, which should bear the routing instruction "*via* Marconi," may be handed in at the Marconi offices in London, Liverpool, or Manchester, or at any postal or railway telegraph office in the United Kingdom.

Sierra Leone.—TELEGRAPH AND TELEPHONE SERVICES.—The annual report for 1924 on the Sierra Leone (West Africa) railway includes an account of the operation during the year of the telegraph system of the country and the telephone exchange in Freetown, both of which are under the management of the railway. The total mileage of telegraph and telephone lines at the end of the year was 1,204, four miles less than in 1923, including 156 miles of telephone lines in Freetown. The number of electric train-staff instruments was 78, the number of telegraph instruments was 40, and the number of telephone circuits on the Freetown exchange was 88, or six less than in 1923. The double military line from Port Lokko to Mabanta was bought from the Army and dismantled, and the best of the material was used for the construction of a new line from Port Lokko in a northerly direction through Mange to the trading centre of Kambia. There is now a through line from Songo to Kambia, while a branch line of about three miles was constructed from Loawa, in the Northern Province, to Mattru. Since the departure in January, 1922, prior to retirement, of the European telegraph superintendent, the section has been in charge of an African telegraph inspector. Mr. Bennett, assistant engineer-in-chief of the Nigerian Posts and Telegraphs Department, following an inspection, reported that the section was in an unsatisfactory state. However, at the date of the report under review, May 1st, 1925, Mr. G. Cresswell, of the Nigerian Posts and Telegraphs Department, had just arrived to take up the appointment with the title of assistant telegraph engineer. He is responsible to the chief engineer of the railway and has a very large amount of work in front of him. Excluding messages on railway service, the number of telegrams dispatched during the year by the public increased by 1,682 to 45,206, and Government messages increased by 5,852 to 18,299. The number of subscribers, excluding the railway, connected to the Freetown telephone exchange was 34 public and 15 Government. Telegraph revenue increased by £773 to £5,500, and telephone income increased by £71 to £1,334.

Switzerland.—AUTOMATIC TELEPHONY.—The Bollwerk central telephone exchange in Berne is to be converted into an automatic station. The installation will provide for 4,400 connections, with an eventual capacity of 9,000; extensions are also to be made at the various sub-exchanges. The contract for the work has been placed with the Siemens & Halske Co., of Berlin.

The Telephone Service.—NEW EXCHANGE.—A new telephone exchange was opened on August 20th in specially-designed premises in Coolfinn Road, Victoria Docks, E.16, to meet the increased demand for telephone service in the neighbourhood of the Albert Dock. Equipment of the central battery type has been fitted, and accommodation for 1,500 subscribers' lines has been provided, with capacity for extension to 4,000 lines. The new exchange will serve an area of about six square miles now served by the East and East Ham exchanges, from which 900 lines were transferred, says the *Morning Post*, at the time of opening. To carry the traffic between the Albert Dock and other London exchanges 195 outgoing and 180 incoming junction lines have been provided. An estimated daily traffic at the time of opening of 22,000 outgoing and incoming calls will be handled by a staff of 31 telephonists.

Radio Notes.

Interference Elimination.—WAVE-LENGTH TESTS.—The night of August 31st—September 1st has been chosen for the all-Europe test in connection with the scheme to allocate every station such a wavelength as will prevent interference between one country and another. Practically every broadcast station throughout Europe will alter its wavelength, and nearly all the British stations will do likewise. The test will last for two hours, and will begin at midnight. Every station will transmit its own programme, and announce its identity every few minutes, so that any interference can be detected by listeners in every country in Europe except Russia; the National Physical Laboratory is acting for the B.B.C., and the success of the scheme depends on the accuracy of transmitting on the allocated wavelengths. Never before have fractions of a metre been used by B.B.C. stations. Representatives of the various countries will afterwards meet at Geneva to compare notes before the final scheme is put before their respective Governments for approval.

Long-distance Relaying.—A "CENTRAL" RECEIVER.—A season of international entertainment will be available to listeners this coming winter, for it is hoped to complete the new "central" receiving station which the B.B.C. is building at Hayes, near Bromley, in Kent, early next month. In October this plant will pick up American and Continental programes and relay them to Daventry, whence they will be re-radiated. The B.B. Co. has been developing proposals for the exchange of programmes in this manner, and the new station will have a 300—500-metre receiver, and another for shorter bands for long-distance reception. Direction-finding apparatus will be provided for locating sources of interference and for assisting in calibrating B.B.C. stations.

Russia. — SOVIET BROADCASTING. — The Soviet authorities evidently regard radio-broadcasting as an excellent means of propaganda, for the *Daily Mail* reports that over 6,000 workers' clubs have been fitted with receiving sets, and 12,000 reading rooms for the public have now been similarly equipped. When the British Broadcasting Co.'s experimental station at Hayes is ready, listeners in this country will have an opportunity of judging the quality of the Soviet broadcast programmes, as relayed by 5XX.

United States.—RANGE TESTS.—Between 12.30 and 5.30 a.m. B.s.t. on August 25th and 26th, the General Electric Co.'s station at Schenectady, W.G.Y., was to broadcast test programmes on a wave-length of 380 metres as part of the experiments announced a fortnight ago. The power was to be changed every 15 minutes from 2½ kW (its normal output) to 50 kW, and more power will be used in future if necessary, the object being to ascertain the extent to which the range of the station can be extended.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Adwick-le-Street.—Urban District Council. September 14th. Internal wiring for electric lighting of Council houses. (August 21st.)

Australia. — Melbourne.—September 29th. Postmaster-General's Department. Telephone protective apparatus.*

October 20th. Switchboard cable. Sched. C.39, jumper wire. Sched. C.40, bells and buzzers.*

October 7th. Victorian Government Railways. Two electric transporters complete. (AX.2303.)*

Commonwealth. October 27th. Timing clocks and calculagraphs. (August 21st.)

Telephone transmitters. (See this issue.)

New South Wales.—November 11th. New South Wales Railways and Tramways. 5-ton 3-motor electric overhead travelling crane, 56 ft. 2 in., for iron and steel foundry, Eveleigh workshops.

September 23rd. Four feed-water meters for White Bay power house.

October 15th. Newcastle City Council. 2,000-kW, or, alternatively, 1,500-kW turbo-alternator, complete with condensing plant.—*Tenders.*

Belgium.—September 23rd. Ministry of War. 4,500 km. of field telephone cable.*

Edinburgh.—September 14th. Royal Infirmary. Supply of X-ray and electro-medical equipment for the new Radiological Department. (August 14th.)

September 7th. Electricity Supply Dept. Electric lighting installations at 288 houses under the Gorgie housing scheme. Specifications from engineer's office.

Egypt.—Cairo.—September 15th. Director-General, Mechanical Department, P.W.M., Cairo. Six generating sets for steamers for the Government workshops, Bulag.

Ministry of the Interior. Supply and installation of an electric power station and distributing system for the town of Minieh.*

India. — September 15th. Madras and Southern Mahratta Railway Co., Ltd. Telegraph line materials, copper wire, &c. (August 21st.)

London.—H.M. Office of Works.—September 15th. Supply of electrical and mechanical engineering labour in daywork in Cardiff. (See this issue.)

Bermondsey.—September 9th. Board of Guardians. Six months' supplies of electric lamps. Forms of tender from Mr. H. H. Reeve, Clerk to the Guardians, 283, Tooley Street, S.E.1.

Westminster.—September 9th. Board of Guardians. Electrical lamps, fitting, &c. Forms of tender from Mr. W. J. Leckley, Clerk to the Guardians, Guardians Offices, Princes Row, S.W.1.

Newport (Mon.).—September 7th. Electricity Department. Induced draught plant, extension of flues, &c. (August 21st.)

New Zealand.—Marlborough.—Electric Power Board. September 22nd. Two 750-h.p. turbines, with generators, switchboard, &c., for Waihopai River development.

Northampton.—September 4th. Town Hall and Markets Committee. Installation of new electrical fittings, lamps, switches, and winches, &c., in the Guildhall, Northampton. (See this issue.)

Portsmouth.—September 1st. Tramways Committee. Stores for 12 months, including insulating materials, lamps, overhead line materials, &c. (August 21st.)

Rochdale.—September 9th. Paving and Sewering Committee. Motors and electrical gear, together with the necessary wiring in connection with the electrification of sludge pressing machinery at Roch Mills sewage disposal works. (August 14th.)

South Africa.—Johannesburg.—October 1st. Railways and Harbours. Four 4-ton electrically-driven portable jib cranes, complete. (A.X.2299.)*

Stoke-on-Trent.—Stoke and Wolstanton Union. Installation of an electrically-driven pumping plant at the Turnhurst Road Institution, Chell. Specification from Mr. T. Wood, Clerk to the Guardians, Stoke-on-Trent.

Town Council. E.h.p. testing equipment. (August 21st.)

Warrington.—September 7th. Electricity Department. Twelve months' supply of earthenware conduits. (August 21st.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Glasgow.—Corporation. Accepted:—

100 time switches for hiring purposes.—Venner Time Switches, Ltd.

Government Contracts.—The following Government contracts were placed during August, 1925 :—

Admiralty (Civil Engineer-in-Chief's Department).

Electric cable.—British Insulated & Helsby Cables, Ltd.

Admiralty (Contract and Purchase Department).

Batteries.—Chloride Electrical Storage Co., Ltd.; D.P. Battery Co., Ltd.; Tudor Accumulator Co., Ltd.
Distributing boards.—Dorman & Smith, Ltd.
Conduits.—Talbot Stead Tube Co., Ltd
Air coolers.—Reavell & Co., Ltd.
Cooling tower.—Davenport Engineering Co., Ltd.
Copper tubes.—J. Wilkes, Son & Mapplebeck, Ltd.
Morse keys.—Baird & Tatlock, Ltd.
Electric lift.—W. Wadsworth & Sons, Ltd.
Motors, control gear, and spares.—Laurence Scott & Co., Ltd.
Transmitting panels.—H. W. Sullivan, Ltd.
Radiogoniometers.—Gambrell Bros., Ltd.
D.p. switches (5 and 15 amp.).—Hawkers, Ltd.; Barr & Stroud.
2-ton and 3-ton electric overhead travelling cranes.—T. Smith & Sons (Rodley), Ltd.

War Office.

Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Western Electric Co., Ltd.
Aerial frame windings.—Fuller's United Electric Works, Ltd.
Generators.—Small Electric Motors, Ltd.
Rotary transformers.—W. Mackie & Co., Ltd.

Air Ministry.

Push buttons.—Pinnacle Switchgear, Ltd.
Motor generators.—Small Electric Motors, Ltd.
Generators and spares.—W. Mackie & Co., Ltd.
Magnetos and spares.—British Thomson-Houston Co., Ltd.
W./t. valves.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Mullard Radio Valve Co., Ltd.; British Thomson-Houston Co., Ltd.
Voltmeters, thermo-ammeters, and milliammeters.—E. Turner.

Post Office.

Telephone apparatus.—Bonnella Bros., Ltd.; British Insulated & Helsby Cables, Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Houghton Butcher Mfg. Co., Ltd.; B. W. Johnson; London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Telephone Mfg. Co., Ltd.; T. Watson; Western Electric Co., Ltd.
Testing and protective apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; W. Jones & Co.; Phœnix Telephone & Electric Works, Ltd.; Power Equipment Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Battery parts.—Chloride Electrical Storage Co., Ltd.; Pritchett and Gold & E.P.S. Co., Ltd.
Cable (various).—British Insulated & Helsby Cables, Ltd.; Connolly's (Blackley), Ltd.; Enfield Cable Works, Ltd.; Fuller's United Electric Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.
Joint-box castings.—Britannia Lathe & Oil Engine Co., Ltd.; Jones and Attwood; United Steel Cos., Ltd. (T. Butlin & Co.).
Loading coils.—Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Telephone cords.—British Insulated & Helsby Cables, Ltd.; London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Ward & Goldstone, Ltd.; Western Electric Co., Ltd.
Electric light fittings.—J. Lane & Sons, Ltd.
Insulators.—Bullers, Ltd.; T. De la Rue & Co., Ltd.; Doulton and Co., Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Lead sleeves.—G. Farmiloe & Sons, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Copper wire (annealed).—T. Bolton & Sons. Ltd.
Enamelled copper wire.—Concordia Electric Wire Co., Ltd.
H.d. copper wire.—Nevill, Druce & Co., Ltd.
Soft ditto.—Enfield Cable Works, Ltd.
G.i. wire.—Lancashire Wire Co., Ltd.; Shropshire Iron Co., Ltd.; Dorman, Long & Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Bristol-Weston-super-Mare: Pirelli-General Cable Works, Ltd. Bo'ness Junction-Bo'ness, Liverpool-St. Helens, Manchester-Bolton: British Insulated and Helsby Cables, Ltd. Birmingham-Walsall and Leicester-Rothley: Siemens Bros. & Co., Ltd.
Conveyors (Mount Pleasant new sorting office).—H. Simon, Ltd.
E.h.p. switchgear (K. E. B. sub-station).—Ferguson, Pailin, Ltd.
Electric lift (Leicester telephone exchange).—Medway's Safety Lift Co., Ltd.
Electric lighting installation (Sheffield P.O. and Telephone Exchange).—Marsh Bros. (Electricians), Ltd.
Telephone exchange equipment.—Hull Toll and Hatch End: General Electric Co., Ltd. New Cross, Putney, Ilford, Albert Dock, Western, Croydon, Lee Green, Palmer's Green, Walworth, Tottenham, Ravensbourne, Greenwich, Barnet, Wanstead, Enfield, Cosham, York, Richmond, and Walton-on-Thames: Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Tudor Accumulator Co., Ltd., for batteries; Electric Construction Co., Ltd., for charging machine; Newton Bros. (Derby), Ltd., for ringing machine. Southport, Birkdale, Churchtown and Ainsdale; Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Alton Battery Co., Ltd., for batteries; Newton Bros. (Derby), Ltd., for machine plant. Burgh Heath: British L. M. Ericsson Mfg. Co., Ltd. Sub-contractors: Tudor Accumulator Co., Ltd., for batteries; Crompton & Co., Ltd., for ringing machines. Chesterfield: Siemens Bros. & Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. Staveley: Siemens Bros. & Co., Ltd. Toll (London): Western Electric Co., Ltd. Sub-contractors: Electric Construction Co., Ltd., for machine plant.
Private branch exchange equipment.—Shanks & Co., Ltd. (Barrhead, Glasgow); W. Delaney & Co. (Manchester); J. Waddington, Ltd. (Leeds); J. & H. Robinson, Ltd. (S.E.8); Lines Bros., Ltd. (Merton); S. H. Benson, Ltd. (Kingsway); Coutts & Co. (W.C.2); Battersea Borough Council; Wagon Repairs, Ltd. (Birmingham); Relay Automatic Telephone Co., Ltd.

H.M. Office of Works.

Lift (Foreign Office).—Marryat & Scott, Ltd.
Engineering labour (Manchester district).—Meta Mfg. Co., Ltd.
Cable.—Fuller's United Electric Works, Ltd.; The Receiver, H. W. Smith and Co. (1920), Ltd.

Crown Agents for the Colonies.

Paper-insulated cable.—W. T. Glover & Co., Ltd.
Electric light fittings.—J. Stone & Co., Ltd.
Electric lighting materials.—Siemens Bros. & Co., Ltd.
Electrical materials.—Belliss & Morcom, Ltd.
Flood alarm cabinets.—General Electric Co., Ltd.
Frequency changers.—Brush Electrical Engineering Co., Ltd.
Train lighting spares.—Chloride Electrical Storage Co., Ltd.
Telegraph ironworks, &c.—Bullers, Ltd.
Telephone materials.—British L. M. Ericsson Mfg. Co., Ltd.
Bronze wire.—Shropshire Iron Co., Ltd.
Copper wire, &c.—R. Johnson, Clapham & Morris, Ltd.
G.i. wire.—R. Johnson & Nephew, Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

Irish Free State.—DUBLIN.—Contracts placed by the Controller of Stores, Department of Posts and Telegraphs during July, 1925 :—

Battery plates.—D. P. Battery Co., Ltd.
Cells.—Edison Swan Electric Co., Ltd.
Copper wire.—British Insulated & Helsby Cables, Ltd.
Insulators.—Wm. J. Kellie.
Spindles for insulators.—W. F. Dennis & Co.
Telephone accessories.—Hall Telephone Accessories Co.
Bronze wire.—W. F. Dennis & Co.; F. Routledge.

Polmont.—Nobel Industries, Ltd. Accepted:—

One 21,550-sq. ft. air preheater.—Howden-Ljungström Preheaters (Land), Ltd.

South Africa.—UNION TENDER BOARD.—Among recent contracts placed by the Board (reported in the *S.A. Mining and Engineering Journal*) are the following :—

Underground cable.—Eugene Phillips Electrical Works (Canada).
Telegraph material.—Telegraph Manufacturing Co.; Rogers, Jenkins and Co.; Hubert Davies & Co., (Johannesburg); and Stewarts and Lloyds (Pretoria).
Accumulator battery for Slangkop radio station (£1,550).—Hubert Davies and Co.

Southend-on-Sea.—Town Council. Accepted:—

Reconditioning of 750-kW Diesel engine, time and line basis (£2,650, maximum), and erection of exhaust boiler, staging and ladder (£40).—Belliss & Morcom, Ltd.
Waste heat boiler (£435).—Spencer Bonecourt, Ltd.
Coresill (£189 3s.).—Christie & Gray, Ltd.
Motor (£214).—British Thomson-Houston Co., Ltd.

Stirling.—Town Council. Accepted:—

Electrical work at new houses in Bannockburn Road.—Mr. Alexander Brewster.

Thirsk (Yorks.).—The tender of Mr. Eric Thompson has been accepted for installing electric light at the new Thirsk and Sowerby Institute.

Worksop.—Electricity Committee. Accepted:—

Two 510-b.h.p. crude-oil engines and two 320-kW generators.—Vickers-Petters, Ltd.
10-ton overhead travelling crane.—Herbert Morris, Ltd.

Notes.

An Alleged Impostor.—WARNING TO ELECTRICAL ENGINEERS.—We have received from the Town Clerk of Lancaster Corporation the following statement :—For the past year or two it appears that a man named R. C. Milner (*alias* Rollo Milton), who gives as his address 4, Rockley Street, Pendleton, Manchester, has been making applications to electrical engineers for posts as assistant engineer, mains superintendent, station superintendent, charge engineer, &c., and enclosing testimonials, all of which are fictitious. An effort has been recently made by the Lancaster Corporation to make an example of him, but their efforts have met with no greater success than those of others. It may, however, be of some service to record the facts. The Lancaster Electrical Engineer (Major G. C. Milnes, M.C.) last month advertised for a shift charge engineer at a salary in accordance with the N.J.B. Scale, Grade 8, Class B, applicants to have had experience with water-tube boilers and turbo-alternators in an e.h.p. power station. About 40 applications were received, including one from Milner. From a perusal of the application it appeared excellent. The man called to see the Engineer on August 5th, and as the applicant was one, having regard to the excellent application, whom the Engineer would in due course have put on a selected list, he interviewed him. When the Engineer looked at him, his face appeared familiar. The Engineer suggested that he had met him on some previous occasion, but Milner was unable to recollect previous acquaintance. The latter, however, suggested it might have been at the Engineers' Club, either at Manchester or London. As the Engineer is not a member of either club, he said this could not be the case. The matter was then dropped. At the interview Milner impressed the Engineer, and afterwards the Engineer referred to some applications he had received in October, 1923, for the appointment of mains superintendent. He found an application from a Mr. Rollo Milton. This was in many respects similar to that now received from Milner. The Engineer was convinced that Rollo Milton and R. C. Milner were the same person. Milner (or Milton) was interviewed by the Engineer on October 9th, 1923, along with other candidates—that was where he had seen him previously. In 1923 Milner gave his age as 38. His recent application gave 34. The Engineer then doubted the veracity of the present application. He made inquiries from the gentlemen who were purported to have given Milner testimonials—the Electrical Engineers of Bolton, Eccles, and Salford. The result of inquiries revealed that the statements with regard to service at those undertakings were fictitious. It was found that he had never been in the service of those undertakings at all. Milner also stated that he had been with the Leicestershire and Warwickshire Electric Power Company as senior engineer-in-charge for three years. The result of inquiries showed that he was there only a few weeks. The company doubted his competence, and called for his original testimonials. He said he would go to Manchester to get them, but he never returned. The Lancaster Corporation issued a summons charging him with an offence under the Servants' Characters Act, 1792, but the summons could not be served, as the address is apparently only an accommodation address, and the Salford police in whose area he was supposed to reside intimate that Milner is evidently a "bird of passage." Possibly he may be heard of again.

A High-Sensitivity Oscillograph.—Some particulars are given by the *Revue Générale de l'Electricité* of a new form of oscillograph, which is to be especially adapted for use in the plate and bridge circuits of vacuum tubes. It is sentitive within the range below one milliampere, and suitable for frequencies up to 3,000 cycles. In principle it consists of a thin, flat strip of silicon-steel alloy placed in an air gap with is surface perpendicular to the field due to a permanent magnet. The strip is suspended at its centre, and light springs at either end hold it in position. One of these springs is geared to a concave mirror. The coil carrying the current the variation of which is to be indicated, is sunk into the poles of the permanent magnet. The current causes the strip to rock to and fro on its pivot, communicating this motion to the mirror. The use of the silicon alloy suppresses the distortion due to Foucalt currents and to hysteresis. Examples are said to have been given of its application to the recording of noise, both aerial and submarine, the registration of wireless signals, and the measurement of small intervals of time.

Electric Steel Furnaces in Germany.—There are in operation in Germany approximately 100 electric furnaces, compared with 360 in the United States, 150 in Great Britain, 70 in France, 50 each in Italy and Sweden, and 40 in Canada. Germany's participation in the entire electric steel production of the world was 56 per cent. before the war and 21 per cent. in 1918, whereas the United States rose from a participation of 17 per cent. in pre-war years to 45 per cent. in 1918. In 1908 the production of steel in electric furnaces amounted to 0.2 per cent. of the total German steel output, growing to 4.7 per cent. in 1913 and to 16 per cent. in 1918, but declining to 7.6 per cent. in 1920. The electric furnace in steel foundries has largely replaced the crucible furnace, and the Martin furnace to some extent. It is not expected, however, that converters, crucibles, and Martin furnaces will be completely replaced by electric furnaces in the near future. The size of furnaces has been growing in Germany as in other countries, although the largest German furnace in operation has only a capacity of 30 tons. Three types of furnaces are extensively used, the Héroult, Nathusius, and Roechling...-Rodenhauser being the most numerous. A number of steel foundries in Germany are also operating induction furnaces, especially of the Roechling-Rodenhauser type. They are generally two-phase furnaces, and their general electrical and heat efficiency amounts to 60 per cent., compared with 86 per cent. generally assumed for arc furnaces. This is not very satisfactory, but it is stated by German foundries that, with due consideration of the cost of the graphite electrodes, initial expense, maintenance, &c., their operation is not more expensive than that of an arc furnace, so that the cost of one ton of steel produced by either the arc or the induction process is almost the same. —*Commerce Reports.*

A Tracing Cloth Substitute.—According to *Electrical World* a transparent celluloid, to be used as a substitute for tracing cloth where permanent drawings are subject to frequent and minor alterations, has been developed and is being used by several large operating companies. It is claimed to be particularly useful where records, maps, connection diagrams, and similar information must be kept up to date continuously, and where periodic reproduction is necessary. The material is about 0.015 in. thick; one side has a smooth finish, and the other a matt surface upon which the tracing is made. Tracings made in this way are said to be almost indestructible, since the ink lines may be easily removed with a sharp scratcher with no injury to the celluloid surface.

Bay of Fundy Tidal Scheme.—The New York correspondent of *The Times* states that by a referendum which is to be submitted to the State of Maine on September 14th next, the approval of the people is being sought for a project to harness the tides of the Bay of Fundy. A scheme has been prepared by Mr. D. P. Cooper, hydraulic engineer, who has selected two inlets on the boundary of Maine and New Brunswick—Passamaquoddy Bay, for the upper pool and Cobscook Bay, in Maine, for the lower pool. He proposes to build locks and dams across the narrow passages between the islands at the entrances to the pools, whilst between the two pools there will be a separating wall 2,600 ft. long, on which power houses will be placed. By opening the gates of the upper pool only during a rising tide and the gates of the lower pool only at low tide, there will be maintained a continuous difference in level between the two pools. The water pouring down from the upper to the lower pool should then yield a minimum of 500,000 h.p. throughout the year, Mr. Cooper asserts, with a possible maximum of 700,000 h.p. if required. It is estimated that the cost of construction will be about £15,000,000, and that the work will occupy 5,000 men for five years. If the Maine referendum is favourable, Mr. Cooper will approach the Canadian and United States Governments for sanction to the scheme. The Governor of Maine has endorsed the proposal.

Shannon Power Scheme. — Preliminary work on the Siemens-Schuckert Shannon scheme has begun in Co. Limerick. The Berlin office of the firm has completed its arrangements for the shipment of plant, and the first consignment will reach the Shannon in about four weeks. Railway connections must be built between the harbour and Limerick Railway Station and also from Long Pavement to Ardnacrusha, where the power station is to be erected. The railway work is expected to be finished by December, and it will employ some 600 men. The actual work of canal excavation will begin in the spring.—*The Times.*

A Wooden Pole Support.—A pole support, the "Malone," has, according to the *Electric Railway Journal*, been placed on the market by the Blaw-Knox Co., Pittsburgh, Pa. It is designed to reinforce wooden poles that have rotted at the ground line, but are otherwise in good condition. The support consists of three galvanised pressed and flanged steel plates adjustable to poles from 10- to 14-in. diameters at the ground level. These plates are arranged to clamp around the pole by means of bolts and washers, and are fastened to three "Malone" concrete anchors.

Canadian Mica Discovery.—What is claimed to be the largest "show" of mica unearthed in Ontario has been discovered at North Hastings, a short distance from Bancroft, by Sorser & Co., who have shipped three cars (120 tons) to the United States market. Crystals weighing as much as two tons have been taken from the show. The company proposes starting a factory there in the near future for the purpose of cutting mica to size. Experts who have visited the property assert that it is the largest yet found in Ontario.

An Acid-proof Apron.—In order to meet the demands of the new Home Office Accumulator Regulations (para. 14), that protective clothing for use in accumulator charging shall consist of "an apron made of material impervious to water, &c.," the Ray Manufacturing Co., Bristol, has placed on the market the "Raymac" acid-proof apron. This overall apron is claimed to be impervious to water and to be unaffected by sulphuric acid. It is made of a specially selected rubber composition, and is of three-ply construction to enable it to withstand hard wear. It forms a one-piece neatly fitting garment giving full flexibility to the body under working conditions; it is reversible, and made to fit any normal size. The buttons for the cross straps are of lead and no seams exist in the article, ensuring that no part is subject to acid attack.

Electric Sign Ban.—Flashing electric signs are not to be allowed in the city of Oxford under a town-planning scheme now under consideration, says the *Daily Mail*. It is felt that night signs having the appearance of intermittent illumination and roof signs are out of place in the University city, and it is proposed under the preliminary scheme to prohibit them.

New Power Development in Canada.—The purchase by the Kingdon Mining, Smelting, and Manufacturing Co. of power rights and property in the vicinity of Chats Falls, on the Ottawa River, is announced. The James Robertson Co., of Montreal, controlling the Kingdon Co., intends to start work shortly on a lead and zinc manufacturing plant which will cost in the neighbourhood of $2,000,000, as well as a large water project. The power development will probably be a joint enterprise between the company and the Ontario Hydro-Electric Power Commission, which expects to erect a power plant on the Ontario side of the river.

Accident. — Walter Hazelhurst (29), electrician, of Firwood, was admitted to Bolton Infirmary on August 20th suffering from burns to the hands received while cutting a cable.

The Institution of Electrical Engineers.—At the invitation of the Salford Corporation Electricity Committee, an afternoon inspection of the new Agecroft power station will be made by the members of the North-Western Centre on Thursday, September 24th. Arrangements have been made for lunch at the Engineers' Club, and transport in covered motor coaches will be provided.

Appointments Vacant.—Plumber-jointer for the Peterborough Corporation electricity department. Combustion engineer for the North Metropolitan Electric Power Supply Co. Electrical engineer for the Mains Department of the Calcutta Electricity Supply Corporation. (See our advertisement pages to-day.)

The Natal Railway Electrification.—A Durban correspondent of *The Times Trade and Engineering Supplement* states that in a number of instances the actual cost of equipment in connection with the electrification of the Natal railways has been considerably in excess of the estimates. Referring to the actual working, he says that very little trouble has been experienced, and it is considered that when further experience has been gained in the operation of the system and initial difficulties have been overcome, the advantages of the scheme as a means of improving and cheapening the working of traffic will be apparent, and also that in due course the anticipated benefit to the community from the provision and distribution of electric power at low rates will be fully realised.

Electricity in Mining.—The extent to which the use of electricity has developed in the South Wales mines is indicated by a recent statement by Mr. Theodore Stretton, president of the Association of Mining Electrical Engineers, that in that area the Powell Duffryn Co. alone uses about 160 million kWh per annum.

Electrolytic Method of Accelerating Corrosion.—In a paper by Messrs. Robert J. Anderson and Samuel H. Brooks, reprinted from *Mechanical Engineering*, dealing with a series of tests made on the accelerated electrolytic corrosion of brass, it is interesting to note the method of acceleration employed. The material to be tested is made the anode in the corroding medium (an electrolyte), and platinum wire is used as the cathode. A small current density is imposed through suitable connections, properly regulated, and the anode is rotated in the electrolyte. After a suitable time the sample is removed, washed, dried and weighed, and the actual loss in weight determined. In the particular tests referred to in the paper the brass employed was in the form of condenser tubing, ¾ in. outside diameter and .005 wall thickness. The test pieces were rotated at 140 r.p.m. by a constant-speed motor.

United States Electrical Statistics.—Reports submitted to the *Electrical World* by 77 per cent. of the generator rating of the electricity supply industry indicate the gross revenue from the sale of energy during May was $110,900,000, an increase of 9 per cent. over May, 1924. During the month the gross revenue was 5.3 per cent. below the estimated normal for that month, this normal being based on the operations for the past five years. The operating expenses during May totalled $51,250,000, a gain of 7.3 per cent. over the corresponding month of last year.

A Lightning Discharge.—During a thunderstorm on Sunday (23rd inst.) a block of two Council houses in Dene Avenue, Lemington-on-Tyne, was struck by lightning with rather interesting results. A correspondent (W. E. P.) informs us that the house was the lowest in the immediate vicinity; it had no wireless aerial, but neighbouring houses had.

The lightning struck the middle chimney stack, dislodging the three top courses of bricks and several tiles. It then spread throughout the fabric of the house by means of the gas pipes embedded in the walls, bursting off patches of cement plaster and burning the pipes at damp spots and at sharp bends, and blowing out staples where these were used to secure the pipes. It finally earthed through the water pipes, dislodging a bracket holding a cistern in the bathroom.

It is interesting to note that the damage occurred where contact resistance between fabric and metal was lowest, at points of high inductance (bends in pipes), and at points of high discharge density (staples).

Charges for Electricity Supply.—The following letter arrived too late for inclusion in our "Correspondence" columns:—

I note the remarks of your correspondent "Stung," and beg to explain a few of his statements which are inclined to be misleading.

With regard to the statement that the Manchester Electricity Department installs cookers at 7s. 6d. per quarter, the impression is given that this is the only price, which is not so, as cookers are hired in three sizes at quarterly rentals of 5s., 7s. 6d., and 12s. 6d., the 5s. cooker being of ample size for the requirements of a household up to four persons. While admitting that the Gas Department will install a certain type of gas cooker free, a decent type with an enamel finish is, I believe, 5s. per quarter.

"Stung" is correct in his assumption that he has to pay 10s. per quarter "minimum charge," or £2 per annum, but should his consumption exceed this amount the following quarter, he would receive a rebate. Does a consumer expect the Manchester Corporation to fix meters, cut-outs, and service (6 yards) free without any guarantee for the expenditure involved? It must be remembered that the Manchester consumer is not burdened with meter rents as a large proportion of other consumers are, and with regard to the £1 deposit, this is in the nature of a guarantee, and as long as this sum is in the keeping of the Corporation, interest is paid on it.

Lastly, I should be interested to hear of the towns in the neighbourhood of Manchester which, to use the words of "Stung," "make lower charges." I am under the impression that Manchester supplies the cheapest electricity for domestic use in South Lancashire, while the undertakings bordering the city—Salford, Eccles, Stretford, Sale, Cheadle, Stockport, Altrincham, &c.—do not hire-out electric cookers at all, and their rates of charge are certainly not under those of Manchester.

In view of the fact that the number of cookers ordered from the Manchester Corporation runs into four figures, and that they are installed in municipal houses, at the back of shops in small streets, &c., one can hardly call them luxuries, and is tempted to say, not: "Save me from my friends," but "What a friend we have in the Corporation."—F. C. Dain, Stretford, Manchester, August 24th, 1925.

Completion of Canadian Electrification Project.—The electrification of the main line of the Canadian National Railways between Lazard and St. Eustache was, says the *Electric Railway Journal*, completed on June 29th, giving the company a direct electric line from the Tunnel Terminal to St. Eustache, and permitting the removal from service of the storage-battery car which has been operating between Montreal and St. Eustache. The concern will put two new multiple-unit electric cars on this line in place of the storage battery line. The new cars were constructed in the Point St. Charles shops; they have an overall length of 80 ft., and accommodate 88 passengers, 72 of whom can be seated in the main body of the car.

Anthracite Coal in Devon.—According to the *Colliery Guardian*, operations carried out in the Bideford district since October, 1924, under the direction of Mr. Thomas Thornton, mining prospector, have resulted in the discovery, within a mile and a half of Bideford, of anthracite coal in large quantities. There are three proved seams running parallel at a distance of about 500 ft., and extending a mile and a half on the "strike," which runs 12 miles from the shores of Bideford Bay to Chapelton, in the valley of the River Taw.

Encouraging the Use of Electric Vehicles.—We learn that the New York Edison Co. has recently taken a step which should further encourage the use of electric motor trucks and vans in the United States. It has arranged to supply charging boards and other battery-charging requisites on the deferred payment plan, that is, by a first deposit followed by monthly payments spread over twelve months.

"Non Sulphatable" Lead Accumulators. — At a recent meeting of the Académie des Sciences in Paris, M. Ch. Féry contributed a note on accumulators, in which he stated that the sulphation of lead batteries could be prevented by protecting the negative electrodes from the action of the oxygen in the air and from the positive plates. By applying to an accumulator the same arrangement as adopted in his air depolarisation battery, M. Féry stated that he had been able to produce a secondary battery which, after four months, retained 83 per cent. of its charge capacity, and that after being discharged and put aside for two years it was recharged under normal conditions. The author considered that the new accumulator possessed all the advantages of a dry battery and was destined to have many important uses in telegraph and industrial work.

Educational.—The new session for courses in electrical engineering at the Polytechnic, 307-311, Regent Street, commences on September 28th, the dates for enrolment being September 16th to 25th (19th excepted). The prospectus provides for the first to sixth years' National Certificate and alternative courses.

Tramway Accidents.—In a recent issue of *Verkehrstechnik*, Herr A. Wolf deals at some length with the subject of accidents in tramway operation and the means of securing their reduction. The author considers that there is a "co-efficient of rolling-stock utilisation" above which the risk of accident to passengers increases rapidly. Taking as a basis the latest official figures available of the traffic accidents in Germany between 1899 and 1919, those relating to tramways show that 43.77 per cent. of the accidents affected passengers and 56.23 per cent. pedestrians; of the total only 8.38 per cent. was due to tramway operation, a figure which, in Herr Wolf's opinion, indicates that tramcars are not in themselves particularly dangerous vehicles. The majority of passenger accidents were caused by attempts to board and alight while the cars were running, too sudden application of the brakes, and collisions. The author considers that the number of accidents in the first class can be reduced by the use of folding steps and gates on the rear platform; as regards pedestrian accidents, 34 per cent. are sustained by children, and it is suggested that urban authorities should provide more playing grounds so that children should not have to play in the streets. Although less than 10 per cent. of accidents are due to the rolling stock and the operating staff, Herr Wolf considers that steps should be taken to secure a reduction. He is sceptical as to the value of life protectors or guards, the bulk of them in use in Germany being, in his opinion, too high from the ground, so that while they may prevent a victim from being run over, they are bound to cause him serious injury. He considers it preferable that more attention should be paid to the improvement of brakes, that stopping places should be selected with greater care, and that when they are located in the middle of the road, refuges should be provided. The best solution is to run the tramcars along their own track separated from the public highway, although this can only be done in the case of new roadways of sufficient width. Herr Wolf concludes by recommending that greater attention be paid to overhead conductors and to more careful selection and training of the tramway staff. Experience has shown, he considers, that while it is wise to educate children to traffic dangers, rules and regulations for the public's benefit are of little avail, and that consequently it is the vehicles themselves that must be arranged, equipped, and controlled so as to reduce the number of accidents to the minimum.

Inquest.—Mr. S. Brighouse, coroner, recently held an inquest on the body of Wm. Matthew Hendry (7), who was killed by a "live" wire on the railway at Bootle. The coroner found that Hendry was killed accidentally and expressed the opinion that extra safeguards, such as barbed wire, should be placed on fences as a deterrent.

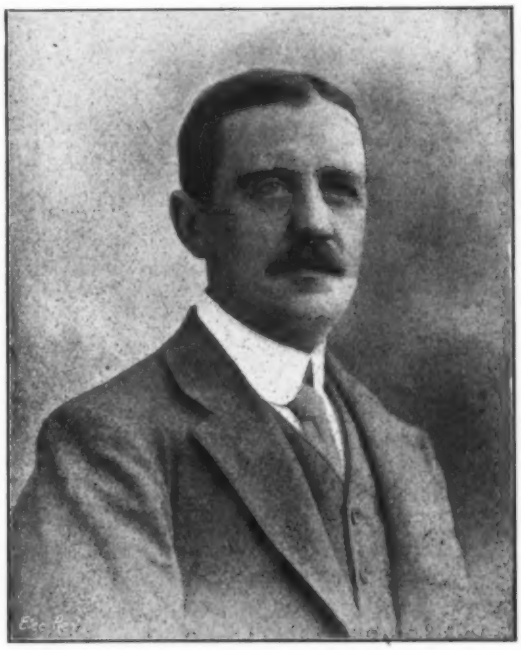
French Electrical Industries.—Some interesting statistics concerning the electrical industries of France are given in the *Electrical World*. The capital invested in these industries in 1924 exceeded 1,000 million francs, including new enterprises and new capital for existing ones. The total capital now employed in the production and distribution of electrical energy is over 4,500 million francs. The number of employés exceeds 25,000. A recent census of the resources lists 109 central stations of capacities of 10,000 kW and over, the total reaching 3,000,000 kW. The smaller stations are rated at 500,000 kW in all. The consumption per head of the population increased by 20 per cent. during the year and is now double that of five years ago. The electrical manufacturing industry has an invested capital of 2,000 million francs against 300 million francs in 1913. Before the war the industry employed 25,000 hands; to-day the figure has increased to 70,000.

N.A.S.E. Scholarships. — The third annual award of scholarships under the auspices of the National Association of Supervising Electricians has just been made. The Examining Board, composed of Messrs. F. Gill, A. Kirk, and W. J. Revell, reports a large increase of entrants and the answers to questions as being very good. The winners of the scholarships are: Supervisors, Mr. E. North (London); Foremen and Associates, Mr. G. Kirk (London), and Mr. A. Olding (London).

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

MR. JAMES TAYLOR, J.P., chairman of British Insulated and Helsby Cables, Ltd. (whose portrait appears herewith), has been intimately concerned with the cable-making industry since 1884, when he joined his brother, the late G. Crosland Taylor, who in the previous year had commenced the manufacture of cables at the Deeside Electric Works, Neston. About the beginning of 1886 the business was converted into a limited company, and the well-known Telegraph Manufacturing Co., Ltd., came into existence. This company played an important part in the manufacture of v.i.r. cables under that style until 1902, when, in order to increase the scope of the business, an amalgamation was effected with the British Insulated Wire Co., Prescot, the original manufacturers of paper-insulated



Mr. James Taylor, J.P.,
Chairman of British Insulated & Helsby Cables, Ltd.

cables in this country, and the combined concern adopted the present title of British Insulated & Helsby Cables, Ltd., Mr. James Taylor becoming vice-chairman of the new board, of which he became chairman in 1918. Mr. Taylor is very closely identified with other branches of the electrical industry, being chairman of the Midland Electric Corporation for Power Distribution, Ltd., the Electrical Finance and Securities Co., the Electric Supply Co. of Victoria, Ltd., and the Colne Valley Electric Supply Co., Ltd., while he is a director of various other companies, including the British Aluminium Co., Ltd., the Automatic Telephone Manufacturing Co., Ltd., the International Automatic Telephone Co., Ltd., and the National Electric Construction Co., Ltd.

We learn that MR. OWEN LETCHER has relinquished the editorship of the *South African Mining and Engineering Journal*. He is succeeded by Mr. J. BURNARD BULLOCK, R.N. (S.R.). Mr. Bullock is an honours graduate in electrical engineering of Durham University and a member of the Institution of Electrical Engineers. He has been associated with mining and engineering in the Transvaal for the past 12 years.

The *Electrical World* reports that Messrs. C. M. SWIFT and R. B. MARCHANT, respectively president and vice-president of the Manila Electric Corporation, have resigned. Mr. J. H. PARDEE, a former vice-president, has been elected president, and Mr. J. I. MANGE has been appointed vice-president.

Among the chairmen of committees appointed by Dr. Pupin, president of the American Institute of Electrical Engineers, is Mr. H. M. HOBART, who has been placed in charge of the committee on electrical machinery. The president has also appointed Mr. SAMUEL INSULL to be a member of the Edison medal committee.

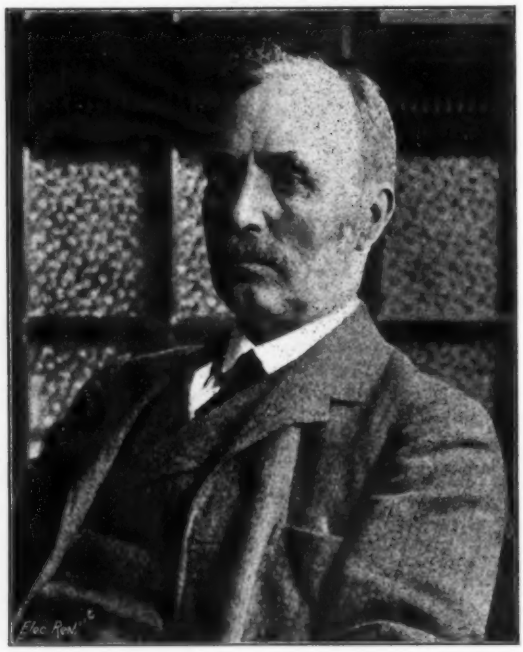
Mr. NORMAN E. NORTH, who for the last 10 years has been associated with Metropolitan-Vickers Electrical Co., Ltd., in the Traction Engineering Department, has resigned his position in order to form, in conjunction with Mr. J. B. ALEXANDER, late director of Ebonestos Insulators, Ltd., the Traction Equipment Co., Ltd., with offices at 36, King Street, Manchester,

and Windsor House, Victoria Street, S.W.1, to handle all forms of electrical apparatus for rolling stock, permanent way, and overhead equipment.

Mr. R. B. HUNGERFORD, managing director of the Western Electric Co. (Australia), Ltd., is at present on a visit to this country. Later he is proceeding to the United States.

MR. J. A. PARTRIDGE, a pioneer of short-wave radio transmission and one of the first to communicate by this means with the United States, has been appointed chief resident engineer at the B.B.C.'s new "picking-up" station at Hayes.

MR. DANE SINCLAIR, director and general manager of British Insulated & Helsby Cables, Ltd., whose Prescot works are described elsewhere in this issue, started his electrical career in 1872, when he joined the Telegraph Department of the North British Railway. In 1875 he was one of those selected to go to Japan in connection with the erection of telegraph lines by the Japanese Government, and he remained as inspector for five years. For his services there he was subsequently awarded the Order of the Rising Sun of the Third Class, which at the time was the highest honour that the Japanese Government could confer on a foreigner. Shortly after his return,



Mr. Dane Sinclair,

General Manager of British Insulated & Helsby Cables, Ltd.

Mr. Sinclair was appointed engineer to the National Telephone Co. for the Glasgow district, and subsequently, after the amalgamation of the three principal telephone companies, he became London manager of the new National Telephone Co., and in 1892 he was appointed to the position of engineer-in-chief. He held this position until 1902, when he accepted the invitation of the directors of British Insulated & Helsby Cables, Ltd., to take the position of general manager of that company—an appointment which he still holds—and in 1923 he accepted a seat on the board of directors. During his service with the National Telephone Co. Mr. Sinclair was responsible for many inventions, some of which are in general use to-day. Mr. Sinclair is also a director of the Automatic Telephone Manufacturing Co., Ltd., the International Automatic Telephone Co., Ltd., the Constantinople Telephone Co., the Midland Electric Corporation for Power Distribution, Ltd., the St. Helens Cable & Rubber Co., Ltd., and the Enfield Cable Works, Ltd.

Obituary.—SENOR ZULUETIA.—The death recently occurred at Neguiri, Bilbao, Spain, of Don Juan Urrutia y Zuluetia, the president of the Spanish Associacion de Productores y Distribuidores de Electricidad. The deceased had played an important part in hydro-electric development work in Spain, and was a director of both the Sociedad Hidro-Electrica Española and the Sociedad Hidro-Electrica Iberica.

MR. A. T. HOBBS.—The death occurred suddenly on August 17th of Mr. Alfred Thomas Hobbs. Mr. Hobbs had been engaged in home and foreign cable contracts for a number of the large cable companies. During the last three years he was mains engineer with the Northwood Electric Light & Power Co., Ltd.

Wills.—MR. HUGH L. WILLIAMS, electrical engineer, of Worcester Park, Surrey, left £59,383 gross and £49,012 net personalty.

MR. JOSEPH FURZE, Tavistock, who was superintendent of the Commercial Cable Co., Liverpool, for 40 years, left £17,260 gross and £15,649 net.

The late Mr. DONALD BARNS MORISON, J.P., who was chairman and managing director of Richardsons, Westgarth & Co., Ltd., left £81,735 gross (net personalty £76,014).

New Companies Registered.

Lee De Forest, Ltd. (207,976).—Private company. Registered August 20th. Capital, £500 in 1s. shares. Objects:—To acquire the benefit of inventions connected with radio-telephony and telegraphy and other methods of intercommunication, and apparatus, instruments, and appliances connected therewith, and to develop and work these, &c. The directors are:—Dr. Lee de Forest, Spayten, Dayvil, New York City, U.S.A.; C. F. Elwell, 60, Great Russell Street, W.C.1; H. G. Couchman, 91, St. Julians Farm Road, West Norwood, S.E.27; and Grace Gwyther, 40, Cavendish Avenue, Church End, Finchley, N.W.12. Qualification, 1 share. Remuneration as fixed by the company. Solicitors: Bartlett & Gluckstein, 139, Piccadilly, W. Registered office: 12, Craven House, Kingsway, W.C.2.

Radiophones (1925), Ltd. (207,881).—Private company. Registered August 14th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers, merchants, commission agents, &c. The directors are:—N. Miller, 278, Kingsland Road, E.8, stock-keeper; and F. Padgham, 581, Barking Road, Plaistow, E., company secretary. Qualification (except original directors) as fixed by the board. Solicitors: C. Butcher and Simon Burns, 32, Gresham Street, E.C.2.

Anglo-Polish Chemical Syndicate, Ltd. (207,889).—Private company. Registered August 15th. Capital, £10,000 in £1 shares. Objects:—To manufacture in Poland and other countries synthetic ammonia, nitrogenous fertilisers and other chemical, agricultural, and industrial products, to acquire from the Polish and other Governments and public bodies and persons, concessions, licences, and rights for the construction and working of hydro-electric and other forms of power stations, &c. The subscribers (each with one share) are:—R. H. Palmer, Grove Hill House, Grove Park, S.E.5, clerk; L. E. Holt, 19, Addison Road, Walthamstow, E.17, clerk. The first directors are to be appointed by the subscribers. Qualification, 100 shares. Remuneration (except managing director), if any, £50 per annum, divided between them. Solicitors: Lewis & Yglesias, 6, Old Jewry, E.C.2.

Beardmore (Paisley), Ltd. (207,943).—Private company. Registered on August 17th with a nominal capital of £250,000 in £1 shares. Objects:—To adopt an agreement with Wm. Beardmore & Co., Ltd., and to carry on the business of manufacturers of, and dealers in motor-cars, vehicles and boats, aero engines, aeroplanes, motor launches and motor conveyances of every description, and parts, fittings, and accessories for the same; electricians, electrical and mechanical engineers, machinists, fitters, millwrights, founders, wire drawers, tube makers, saddlers, japanners, enamellers, electro-platers, &c. The subscribers (each with one share) are:—W. J. Newbert, 123, First Avenue, E.12, clerk; and W. C. Gibbs, 214, Victoria Road, Southend, clerk. The first directors (to number not fewer than three nor more than five) are:—Lord Invernairn of Strathnairn (chairman), V. Beardmore Stewart, and J. G. Girdwood. No share qualification required. Remuneration (except nominee of H.M. Treasury), £250 each per annum; of such nominee, such sum as may be approved by the Treasury. Solicitors: Nicholson, Graham & Jones, 19-21, Moorgate, E.C. Registered office: 36, Victoria Street, S.W.1.

Peerless Productions, Ltd. (207,879).—Private company. Registered August 14th. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers of electrical and medical apparatus, specialities, &c. The directors are:—C. H. Rapinet, 148, Queen's Road, Bayswater, W.2, clerk; and R. J. Phillips, "San Marino," Upper Tooting Park, S.W.17. Remuneration, £225 each per annum (except managing director). Registered office: Peerless Works, Cowthorpe Road, Wandsworth Road, S.W.8.

Wenham Lighting Corporation, Ltd. (207,913).—Private company. Registered August 15th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of an electrical and gas engineer and factor hitherto carried on by W. R. Grigsby at 184, Gray's Inn Road, W.C.1. The directors are:—W. H. Lovatt, 21, Ironmonger Lane, E.C.2; and W. R. Grigsby, 1, Observatory Road, East Sheen, S.W.14. Qualification, 5 shares. Solicitors: Stone, Morris & Stone, 41, Moorgate, E.C.2. Registered office: 21, Ironmonger Lane, E.C.

Walbar Engineering Co., Ltd. (207,912).—Private company. Registered August 15th. Capital, £1,000 in £1 shares (250 preference and 750 ordinary). Objects:—To carry on the business of motor and electrical engineers, merchants and brokers, &c. The permanent directors are:—J. Gratrix, 93, Birch Road, Berry Brow, Huddersfield; W. A. Lord, 162, Woodside Road, Lockwood, Huddersfield; J. B. Littlewood, 1, Park Gate, Berry Brow, Huddersfield; and H. Langley, address not stated. Qualification, 50 shares.

Stuart Electrical Co., Ltd. (207,910).—Private company. Registered August 15th. Capital, £4,000 in £1 shares. Objects:—To carry on the business of electrical engineers and contractors, manufacturers of, and dealers in electrical, magnetic, galvanic, and other apparatus, mechanical engineers, &c. The subscribers (each with one share) are:—G. W. Wood, 45, Newman Road, Erdington, Birmingham, electrical contractor and engineer; Mrs. E. L. Wood, 45, Newman Road, Erdington, Birmingham. G. W. Wood shall be permanent governing director, so long as he holds 500 ordinary shares, at a salary of £300 per annum. Solicitors: C. F. Monk, 37, Waterloo Street, Birmingham. Registered office: Union Chambers, Temple Row, Birmingham.

Official Returns of Electrical Companies.

Madras Electric Tramways (1904), Ltd. (80,361).—Capital, £200,000 in £1 shares (125,000 preference and 75,000 ordinary). Return dated May 26th, 1925. 100,000 preference and 75,000 ordinary shares taken up. £85,240 paid on 67,500 preference and 17,740 ordinary shares. £89,760 considered as paid on 32,500 preference and 57,260 ordinary shares. Mortgages and charges, £130,000

Orford Electric Light and Power Co., Ltd.—Issue on July 20th, 1925, of £100 debentures, part of a series already registered.

W. H. A. Robertson & Co., Ltd. (95,906).—Return dated July 13th, 1925. Capital, £36,000 in 600 ordinary and 3,000 preference shares of £10 each. 600 ordinary and 2,180 preference shares taken up. £5 per share called up on 430 preference and £10 per share on 1,750 preference and 600 ordinary shares. £25,650 paid. Mortgages and charges, nil.

A. Hirst & Son, Ltd. (57,889).—Return dated May 28th, 1925. Capital, £20,000 in 100 preference and 1,900 ordinary shares of £10 each. 100 preference and 1,220 ordinary shares taken up. £2,200 paid on 100 preference and 120 ordinary shares. £11,000 considered as paid on the remainder. Mortgages and charges, nil.

British Electric Transformer Co., Ltd. (76,351).—Return dated April 21st, 1925. Capital, £1,000,000 in 300,000 preference and 700,000 ordinary shares of £1 each. 300,000 preference and 325,000 ordinary shares taken up. £539,821 paid on 290,776 preference and 249,045 ordinary shares. £85,179 considered as paid on the remainder. Mortgages and charges, £20,000.

United Electric Tramways of Montevideo, Ltd. (80,456).—Return dated July 2nd, 1925. Capital, £1,000,000 in 100,000 preference and 100,000 ordinary shares of £5 each. All shares taken up. £295,105 paid on 26,221 preference and 32,800 ordinary shares. £704,895 considered as paid on 73,779 preference and 67,200 ordinary shares. Mortgages and charges, £901,621.

Ever-Ready Co. (Great Britain), Ltd. (167,171).—Capital, £500,000 in £1 shares (200,000 preference and 300,000 ordinary). Annual return dated June 11th, 1925. 165,892 preference and 249,000 ordinary shares taken up. £75,892 paid on 63,892 preference and 12,000 ordinary shares. £339,000 considered as paid on the remainder. Mortgages and charges, nil. A further 34,108 preference shares were allotted, payable in cash and fully called up on June 16th, 1925.

Tingey Wireless, Ltd.—F. W. Lord, 37, Walbrook, E.C.4, ceased to act as receiver or manager on April 21st, 1925. (Notice filed August 15th, 1925.)

Allen West & Co., Ltd. (108,870).—Return dated March 13th, 1925. Capital, £150,000 in £1 shares. 141,724 shares taken up. £141,724 paid. Mortgages and charges, £60,000.

Cawnpore Electric Supply Corporation, Ltd. (84,233).—Capital, £547,986 in £1 shares (160,000 preference and 387,986 ordinary). Return dated June 8th, 1925. 160,000 preference and 160,000 ordinary shares taken up. £245,000 paid on 160,000 preference and 85,000 ordinary shares. £75,000 considered as paid on 75,000 ordinary shares. Mortgages and charges, £360,580.

Llangollen and District Electric Light and Power Co., Ltd. (75,384).—Capital, £6,000 in 3,500 ordinary and 2,500 preference shares of £1 each. Return dated July 16th, 1925. 1,754 ordinary and 360 preference shares taken up. £2,110 15s. paid, leaving £3 5s. in arrears. Mortgages and charges, £3,500.

Melton Mowbray Electric Light Co., Ltd. (53,018).—Return dated April 9th, 1925. Capital at date of return, £40,000 in £5 shares, all issued and fully paid. Mortgages and charges, £19,100. (On April 30th, 1925, the company increased its nominal capital to £60,000 in £1 shares.)

Indo-European Telegraph Co., Ltd. (3,953).—Capital, £450,000 in £25 shares. Return dated May 7th, 1925. 17,000 shares taken up. £425,000 paid. Mortgages and charges, nil.

Eastern Extension, Australasia and China Telegraph Co., Ltd. (7,224).—Capital, £4,000,000 in £10 shares. Return dated June 25th, 1925. All shares taken up. £4,000,000 paid. Mortgages and charges, £752,400.

Pritchett & Gold & E.P.S. Co., Ltd. (166,503).—Capital, £200,000 in £1 shares (100,000 preference and 100,000 ordinary). Return dated April 16th, 1925. 87,267 preference and 84,846 ordinary shares taken up. £2,507 paid on 2,500 preference and 7 ordinary shares. £169,606 considered as paid on 84,767 preference and 84,839 ordinary shares. Mortgages and charges, nil.

Standard Electric Co., Ltd. (68,643).—Return dated June 15th, 1925. Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each. 3,077 preference and 5,000 ordinary shares taken up. £1 per share called up on 4,177 shares and 10s. per share on 400 shares. £3,700 considered as paid, being £1 per share on 3,500 and 10s. per share on 400 shares. Mortgages and charges, £300.

Hooper's Telegraph and India Rubber Works, Ltd. (60,947).—Return dated June 29th, 1925. Capital, £50,000 in 1,000 preference and 4,000 ordinary shares of £10 each. All shares taken up. £40,000 paid on the ordinary; £10,000 considered as paid on the preference shares. Mortgages and charges, nil.

Dynamic Electrical Co., Ltd. (104,436).—Capital, £10,000 in £1 shares. Return dated December 31st, 1924 (filed March 17th, 1925). 7 shares taken up. £7 paid. Mortgages and charges, nil.

Jacqueline, Ltd.—Particulars filed of £2,000 debentures authorised July 20th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,200.

W. A. Saxby & Co., Ltd.—W. A. Saxby, The Greenway, Whitton Road, Hounslow, was appointed receiver and manager on August 10th, 1925, under powers contained in debentures dated April 17th, 1925.

Edward Deane & Beal, Ltd. (92,885).—Capital, £60,000 in £1 shares (20,000 preference and 40,000 ordinary). Return dated December 31st, 1924 (filed June 11th, 1925). 20,000 preference and 20,009 ordinary shares taken up. £9 paid. £40,000 considered as paid. Mortgages and charges, £7,500.

City Notes.

Reports and Meetings of Electrical Companies; Dividend Results, &c.

Scarborough Electric Supply Co., Ltd.

The report for 1924, which is to be presented at next Monday's meeting, says that the directors have been in negotiation with the Scarborough Corporation for the purchase by the latter of the whole of the undertaking, which purchase, in any case, the Corporation has power to effect compulsorily in February next year. The directors have, subject to the shareholders' approval, entered into an agreement for the sale of the undertaking to the Corporation at a price to be fixed by arbitration. The shareholders are to be asked to confirm this agreement. The total profit for the past year was £22,878, and to this are added £8,240 brought forward, and £50 bank interest, making a total of £31,169. Out of this sum the directors have written off £3,619, the balance of the expenses of the debenture issue, and £100 from the apparatus on hire account; debenture interest absorbs £3,600; and £3,000 is placed to reserve, leaving £20,760. A dividend of 6 per cent., free of tax, was paid during the year; it is not proposed to pay a final dividend but to carry forward a balance of £13,018.

Mexico Tramways Co.—The gross earnings for 1924 amounted to $11,692,370 (Mex.), as compared with $1,226,830 in 1923, and the net earnings fell by $991,469 to $154,580. The continued decline in the earnings is attributed to the growing competition of omnibuses and other forms of transport. After meeting general expenses, bond interest and sinking fund allocations, there was a deficit of $543,368, as against $2,950 in 1923, and the 6 per cent. mortgage bonds again receive no interest.

Adelaide Electric Supply Co., Ltd.—The dividend for the half-year ending August 31st has been declared on the 6 per cent. cumulative preference shares.

Mexican Light & Power Co.—The report for 1924 records gross earnings of $15,864,260 (Mex.), as against $14,827,943 in the preceding year. The net earnings fell from $8,309,162 to $7,941,787, due to the larger provision for depreciation. After providing for general expenses and bond interest there is a balance of $2,593,070, which has been contributed to capital expenditure. There is thus again no surplus for the payment of interest on the 6 per cent. income bonds.

Sevenoaks and District Electricity Co., Ltd.—Last week the company published particulars, for public information only, of its capital and undertaking. The authorised capital is £54,948, divided into 89,792 8 per cent. cumulative preference shares and 20,104 ordinary shares of 10s. each, and there are debentures amounting to £49,850, which are convertible at par into preference or ordinary shares. It is proposed to recommend that the shares be converted into £1 shares, the holders receiving one new share for each two old shares.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Sevenoaks and District Electricity Co.—20,104 ordinary shares of 10s. each, fully paid, Nos. 1 to 20,104; 38,200 8 per cent. cumulative preference shares of 10s. each, fully paid, Nos. 1,593 to 39,792; 1,592 new 8 per cent. cumulative preference shares of 10s. each, fully paid, Nos. 1 to 1,592; 29,000 new 8 per cent. cumulative preference shares of 10s. each, 2s. 6d. paid, Nos. 39,793 to 68,792.

Aberdeen Suburban Tramways Co.—There was a profit of £1,937 on working during the six months ended July 31st, and the balance at credit of the profit and loss account is £6,917. It is proposed to transfer £1,500 to the renewal and depreciation account, to pay a dividend at the rate of 7 per cent. for the past year, and, after paying directors' fees, to carry forward a balance of £3,130.

International Telephone & Telegraph Co., Ltd.—It was announced in our last issue that this company had acquired the foreign subsidiary of the Western Electric Co. (U.S.A.). To enable this to be carried out the company is issuing 5½ per cent. convertible debentures, maturing in 1945, at 99 per cent., to the extent of $25 million.

Calgary Power Co.—The accounts for the last financial year show a net profit of $158,342, an increase of $38,632 as compared with the previous year's profit. The increase is attributed to the operation of the new contract with the City of Calgary.

Pinchin, Johnson & Co., Ltd.—The directors report that the results of the past half-year (to June 30th) were so satisfactory that they are able to pay a dividend of 10 per cent. (actual) on the ordinary shares as compared with 8 per cent. for the first half of 1924.

General Electric Co. (U.S.A.).—It is announced that the whole of the issue of 5 per cent. gold debentures maturing normally in September, 1952, are to be redeemed on September 1st, at 107½ per cent., together with accrued interest.

Tilling-Stevens Motors, Ltd.—The directors have given notice that all outstanding 5 per cent. 5-year notes are to be redeemed on August 31st in accordance with the terms of issue.

German Company.—The *Continental Company for Electrical Undertakings*, Nuremberg, reports a net profit of 319,573 marks for the year 1924-25, but no ordinary dividend is to be paid.

Southern Brazil Electric Co., Ltd.—The interest coupon due on January 1st, 1925, of the 6 per cent. mortgage debentures is being paid.

Canadian General Electric Co.—A dividend at the rate of 7 per cent. per annum has been declared on the preference stock for the quarter ending September 30th.

Victoria Falls & Transvaal Power Co., Ltd.—The company reports that the net earnings for the second quarter of the year amounted to £242,785 before providing for taxation.

Melbourne Electric Supply Co., Ltd.—The dividend for the six months ending August 31st has been declared on the 8 per cent. first cumulative preference shares.

Crossley Bros., Ltd.—An interim dividend of 3½ per cent. has been declared on the preference shares.

Stocks and Shares.

MONDAY EVENING.

UNTIL the Bank rate comes down—as it may do on the Thursday in this week—to 4 per cent., the Stock Exchange markets will keep in mind the probable reduction as a bull point for all the investment markets. Prices of sound securities are firm, and the tendency is for values to advance. In such ordinary shares as those, for example, of the cable equipment group, prices continue to make headway. Amongst electricity supply shares, a sudden spurt in County of London ordinary served to enliven the list. In foreign issues, Anglo-Argentine Tramways and Brazilian Tractions stand out with noticeable improvement.

The rise in County of London shares carried the price to 61s. before a setback occurred to 58s. 9d., the latter being

6s. 6d. higher on the week. Rumours of a possible bonus distribution of shares led to the jump in the price. Readers of this column have understood for some time past that the London undertakings are likely to capitalise their reserves and to pay these over to their proprietors, in the shape of shares. Study of the companies' balance-sheets will demonstrate the probability of such a distribution being made, but any conclusions drawn from such examination need to be salted with caution. They may easily prove misleading if handled with too airy optimism. County new preference are 1s. 7½d. premium.

Charing Cross ordinary are 1/16th higher at 48s. 9d. There is an impression that the "City" portion of the Charing Cross Company may be treated a little differently, for the time being, from other members of the London group in the matter of its capital reorganisation. City of London shares at 47s. are also 1/16th up. Newcastle-on-Tyne ordinary and first preference gained sixpence apiece. Bournemouth and Poole, at 3, have put on half-a-crown. Electric Supply Corporation went back to 31s. 3d.; London Electrics are 1s. higher at 34s. 6d.

Shares in the provincial power companies are being watched by people who think that industrial prospects point to early extensions of power developments, and that, in any new issues of capital made to cope with these, the existing shareholders will be given the opportunity for subscribing to shares at bonus prices; that is, at prices lower than those which rule in the market for the present shares. This is the reason why the latter stand at figures which seem hardly justified by the dividends now being paid.

Looking well ahead, some people anticipate the time when there will be a broad and an active market in the shares of the two big concerns that may spring from the amalgamation of to-day's electricity supply concerns into two comprehensive and important undertakings that will control the supply of current and power to London and the Home Counties. Dealings, it may be re-affirmed, have recently started in the new 7 per cent. preference shares of the Shropshire, Worcestershire, and Staffordshire Electricity Co., these shares being obtainable at 21s. 4½d., free of stamp and fee. A full dividend is due next month, and the yield on the money comes to £5 12s. 6d. per cent. On the basis of last year's profits, the dividend is covered 5½ times over.

The investor may be interested to know that a modest amount is available of the Yorkshire (West Riding) Electric Tramways 4½ per cent. first debenture stock at 78¾, January and July interest. The return is £5 14s. 6d. per cent. at this price. Redemption may be effected any time at the company's option at 105, and the interest-service is well covered.

Anglo-Argentine Tramways preference are both higher at the common price of 3¼. The 5 per cent. debenture gained ¼ at 73½. If the Municipality of Buenos Aires accepts its own Committee's recommendation to adopt the Anglo-Argentine Tramways scheme for subway construction, in preference to that submitted by an American firm, this would put an end to the friction which has existed so long between the company and the Buenos Aires Council. Hopes of this materialising are responsible for the better prices now established in the company's issues. Brazilian Tractions at 66 are 2½ up since a week ago, and stand a little higher than the price of the shares on the eve of the war. Expectation looks, here, for a rise to 5 per cent. in the dividend, as already indicated.

The annual reports of the Mexico Tramways and the Mexican Light and Power Companies have now come from Toronto. From these it is evident that settlement in Mexico is still to seek. Both companies are making moderate progress in the face of considerable difficulty. Reluctance to meet their obligations on the part of municipal debtors is still manifest. Labour claims constitute a handicap upon profitable working. Nevertheless, the companies "keep on keepin' on" with a courage and determination that can hardly fail of reward in the future. The only alteration in the prices is a loss of ¼, to 62, in Mexico Tramways 5 per cent. bonds. Para Electric Railway first debenture stock has risen to 44½ in sympathy with the rise in Brazilian Tractions, whose preferred shares are also higher at 68.

Home Railway stocks show little change. Metropolitans rose a point to 68½. Underground £10 shares eased off to 22. British Electric Traction ordinary and preference are better at 113 and 105, respectively.

Indo-Europeans at 42½ have gained 20s., and Great Northerns at 31½ are a fraction up. The Eastern Division has not moved. Wireless shares are equally tranquil. Construction and manufacturing shares are again stronger. The feature is a 3s. rise in India Rubber shares to 22s. 6d., upon prophecies of a 7½ per cent. dividend. The company is at present paying 5 per cent. General Electrics gained a florin at 26s. Siemens are better at 30s., so are British Aluminiums at 3½. Callenders, Henleys, and British Insulated maintain their previously advanced prices, and the market, throughout, is a good one. Iron, steel, and engineering shares are dull; Babcocks eased off to 2 9/16ths. For this, the labour situation at home affords the explanation. People are growing weary of their shares; they are selling them to put the money into more popular areas, such, for example, as the rubber market, where prices are better upon the persistent buying of the good-class shares. Automatic Telephones keep steady at 2 1/16th. International Telephones put on several dollars upon the acquisition from the Western Electric Co. of its subsidiary, the International Western Electric Co.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	1924.	Price Aug. 24, 1925.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	13	14	3xd	+ ⅛	4 13 4
Brompton Ordinary	1	10	10	1⅞	—	*5 14 3
Charing Cross Ordinary	1	14½	15	48/9xd	+ ⅛	6 8 0
do. do. 4½ Pref ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	12	1⅞	—	6 8 0
City of London	1	15	15	47/-	+ 1/16	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—¼d.	5 8 6
County of London	1	15	15	58/9	+6/9	5 2 0
do. do. 6% Pref.	1	6	6	24/-	—	5 4 4
Edmundson's Ordinary	1	7	7	21/-	+6d.	6 13 4
do. 7% Pref.	1	6	7	21/6	—	6 10 3
Elec. Supply Corporation ...	1	10	10	31/3	—2/-	6 8 0
Kensington Ordinary	5	14	15	12⅞	+ ⅛	5 18 8
Lancs. Light and Power	1	7½	7½	25/6	—	5 17 8
London Electric	1	10	10	34/6	+1/-	5 16 0
do. do. 6% Pref.	5	6	6	5⅝	—	5 7 10
Metropolitan	1	10	11	37/-	—	5 19 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	23/3	—	5 4 4
Newcastle-on-Tyne Ordinary ...	1	6	7	22/9	+7d.	6 3 1
do. 5% Pref. ...	1	5	5	18/9	+6d.	5 6 8
do. 7% Pref. ...	1	7	7	24/6	—	5 14 3
Notting Hill 6% Pref.	10	6	6	1⅛	—	6 6 4
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	14xd	—	6 8 0
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref. ...	1	7	7	1½	—	5 12 0
Urban Ordinary	1	4	4	17/-	—	4 14 2
do. 6% Pref. ...	1	6	6	19/6	—	6 3 1
Westminster Ordinary	1	15	15	43/6xd	—	6 18 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	+6d.	7 10 0
Yorkshire Elec.	1	8	8	29/-	—	5 10 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	6⅜	—	5 17 8
Metropolitan	,,	4	5	68½xd	+1	7 6 0
do. District	,,	8½	8½	44½	—	7 17 4
Underground Electric Ordinary	10	Nil	Nil	2⅜	— ⅛	Nil
do. do. "A" ...	1/-	Nil	Nil	7/-	—	Nil
do. do. Income	Bonds	6	6	96	—	*6 2 5

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 15 11
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	3	6	2⅛	—	2 16 2
Chili Telephone	5	6	5	5½	+ ⅛	*4 11 0
Cuba Sub. Ord.	10	5	5	6⅞	—	7 8 2
Eastern Extension	10	10	10	17⅛	—	*5 15 11
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 15 11
Globe Tel. and T. Ord. ...	10	10	10	17½	—	*5 14 1
do. do. Pref. ...	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	22	31½	+ ½	6 19 8
Indo-European	25	7	8½	42½	+1	*5 0 0
Marconi	1	10	10	1⅛	— ⅛	8 0 0
Marconi Marine	1	10	7½	17/6	—	8 11 6
Oriental Telephone Ord. ...	1	12	12	2⅜	—	*5 12 11
United R. Plate Tel.	5	8	8	7⅞	—	5 8 6
Western Telegraph	10	10	10	16⅛	—	*6 3 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅛	+ 1/16	8 9 2
do. do. 2nd Pref. ...	5	6	6	2⅛	+ 1/16	9 4 8
do. do. 5% Deb. ...	Stock	5	5	73½	+2	6 16 1
British Electric Traction Ord. ...	,,	6	6	113	+1	5 6 2
do. do. 6% Pref. ...	,,	6	6	105	+1	5 14
Brazil Traction	100	4	4	66½	+2½	6 1 3
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	88½	—	5 11 9
do. do. Preferred	,,	96/-	96/-	85½	+1	*5 12 6
do. do. Deferred	,,	129/5	129/5	106	—	*6 2
do. do. Deb.	,,	4½	4½	77½	—	5 9 8
Lond. & Sub. Trac. 5% Pref. ...	1	2½	Nil	4/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	42½	—	9 8 4
Mexico Trams. 5% Bonds ...	—	5	5	62	— ½	8 1 3
Mexican Light Common ...	100	Nil	Nil	25	—	Nil
do. Pref. ...	100	Nil	Nil	56	—	Nil
do. 1st Bonds ...	—	5	5	61½	—	8 2
Yorkshire (West Riding) ...	1	5	—	17/6	—	5 14

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	2⅛	—2d.	*4 13 4
British Aluminium Ord.	1	5	10	31/3	+6d.	6 8 0
British Elec. Transformer Pref.	1	Nil	7	17/6	—	... ...
British Insulated Ord.	1	15	15	3⅛	—	4 12 4
Brush Ord.	1	10	10	1⅜	—	8 17 10
Callenders	1	15	15	3⅜	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	⅝	—	... ...
Edison-Swan	4/-	10	10	7/6	—	5 2 9
do. 5% Deb.	Stock	5	5	80½	—	6 4 3
Electric Construction	1	10	10	30/6	—	6 11 9
Enfield Cable, Pref.	1	7½	7½	1⅛	—	6 6 0
English Electric	1	5	5	18/9	+1/-	5 6 8
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 6
do. Ord.	1	5	7½	26/-	+2/-	5 15 5
Henley	1	15	16	3½	—	4 18 6
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	22/6	+3/-	*4 9 3
Johnson & Phillips	1	10	10	2⅜	+ ⅛	4 9 3
Met-Vickers, Ord.	1	8	8	24/4	—	6 10 8
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	1⅛	+ 1/16	5 6 0
Telegraph Construction	12	20	20	26½	—	4 10 0

* Dividends paid free of Income Tax.

Electrical Accidents in Mines.

The Report of H.M. Electrical Inspector of Mines for the Year 1924.

As was the case for the year 1923, the report of H.M. Electrical Inspector of Mines for 1924* has been issued as a separate publication. An abstract of its contents is given below.

During the year the British Engineering Standards Association was requested by the Mining Association to undertake the preparation of specifications for such colliery requisites as were amenable to standardisation. A representative Sectional Committee was set up accordingly to organise and direct the work, and Regional Committees were formed with a common and definite programme for consideration. This preliminary investigation did not embrace electrical equipment, but one of the Regional Committees has already detailed a sub-committee to consider and report what components of the electrical installation may be standardised with advantage. Further progress in this direction may be expected during 1925.

During the past year the use of electrical energy increased by 117,758 h.p., making a total of 1,481,932 h.p. It is regrettable that there were again no fewer than 14 fatal accidents due directly or indirectly to the use of electricity. In 12 instances one life was lost in each case; there was one double fatality from electric shock, and in one of the two instances where gas was ignited four lives were lost, making in all a total of 18 deaths. With one exception all these accidents occurred below ground. Thirteen lives were lost by electric shock and five deaths were due to ignitions of gas. All occurred at coal mines.

Summarised Account of Electrical Accidents Resulting in Loss of Life during 1924.

1. *New London Colliery, Notts.* January 24th.—Deceased, a coal-cutter machine man, received a fatal shock from the plug of the trailing cable. It was found that the earthing conductor in the cable had been pulled out of its terminal, while one of the live conductors was also detached from its terminal and was touching the metal plug case so that this was "alive." The system was 3-phase at 500 volts, and the neutral point was earthed.

2. *Bowhill Colliery, No. 1 Pit, Fife.* April 17th.—Deceased, a miner, received an electric shock during an attempt to free an electric coal-cutting machine which had become wedged between roof and floor at the face where a 19-in. seam was being worked. Subsequent examination of the machine failed to disclose a point at which the insulation had broken down, but discovered that it was not possible to screw the "earthing pin" up properly so as to make a reliable electrical connection for the earthing circuit. The plug box on the machine had been repaired at some time, and a home-made "earthing pin" had been fashioned in such wise that the shoulder of this pin would not pass through the hole in the cover plate of the plug box, with the result that it was not possible to screw this pin sufficiently far in to apply pressure to the face of the plug casing, in accordance with the original purpose of the device. The system was 3-phase, 500 V, with free neutral.

3. *Cowdenbeath Colliery, No. 7 Pit.* April 17th.—Deceased was in charge of a coal-cutting machine and received a shock during an attempt against orders to repair a trailing cable and plug. His death was due to his ignorance, and followed an attempt to remove a similar plug without turning off the machine switch with which it was mechanically interlocked. The system was 3-phase at 500 V, with free neutral.

4. *Newton Cap Colliery, Durham.* May 13th.—Deceased was working a coal-cutting machine as chargeman when he received an electric shock from the machine. It was found that the earthing conductor in the trailing cable had been pulled out of its terminal, and that there was another defect, with regard to one of the live conductors, so that the machine frame ceased to be earthed and became charged electrically. The system was 650 V. 3-phase, with free neutral.

5. *Bridgewater No. 3 Pit, Lancashire.* May 30th.—Deceased was employed as a haulage attendant and was found unconscious near an open-type liquid controller. He had failed to turn off the main switch in the stator circuit when shutting down the motor, so that, although the motor was not running, the rotor circuit was energised inductively. A test with a voltmeter showed that the open-circuit rotor pressure was 400 volts. One slip ring was connected to the frame of the liquid controller and the other two slip rings to two insulated contact plates mounted on the two sides of the controller drum.

6. *Hartley Bank Colliery, Yorks.* May 23rd.—Six men working with, or in the vicinity of, an electrical coal-cutting machine, suffered serious burns, to which four of them succumbed, as a result of the ignition of firedamp attributable to open sparking at the reversing switch of the machine. It was found that one set screw was missing out of four intended for securing the base of the plug box to the side of the reversing switch box, so that a circular opening about 7/16 in. in diameter was left in the switch box permitting the entry of gas and the emission of flame.

*Stationery Office. Price 6d.

7. *Newbiggin Colliery, Northumberland.* July 23rd.—Deceased, employed as a pony driver, while waiting at the bottom of a dilly, raised his arms and took hold with both hands of a steel roof girder which was "alive" at the moment, owing to a defect of insulation in an electric light fitting. Investigation showed that joints had been made in the wiring of the lamp fitting and had been insulated with black tape, and that there had been a leakage of current between one of the conductors and the metal frame of the lamp fitting, which had burned a hole through the tape.

8. *Penrhiwceiber Navigation Colliery, No. 1 Pit, Glamorgan.* August 2nd.—Deceased, employed as an electrician, had been engaged during the preceding day in making a joint in a 3-core wire-armoured high-pressure cable. The following morning deceased, with three other electrical workmen, returned to the place to complete his work, and while they were otherwise engaged in the vicinity he opened the box and began to remove the temporary insulating tape without first seeing that the pressure had been cut off from the cable, with the result that he received a shock which proved fatal immediately. The system was 3-phase at 2,200 volts, with free neutral.

9. *Gwaunclawdd Colliery, Brecon.* August 18th.—Two men, a fireman and a haulier, were burned as the result of an ignition of methane attributable to open sparking at the commutator of a direct-current motor used for driving a pump, and the haulier died. Another fireman, who entered the district to investigate after the occurrence, was overcome by afterdamp, but was rescued and revived. The motor was of the totally-enclosed type, *i.e.*, the enclosure was intended to be such as to prevent free circulation of air between the inside and outside of the case, but not such as to be termed airtight.

10. *Lady Helen Colliery, Fife.* October 2nd.—Two coal-cutting machine men were killed by electric shock in a place which was 2 ft. 6 in. high while removing a sheet of corrugated iron, 8 ft. long by 2 ft. 3 in. wide, by sliding it on one long edge over the live trailing cable, between the machine and the props, in order to bring it into the road head. The electrical system was 3-phase at 500 V, the neutral point being earthed through a limiting resistance of 10 ohms. The accident was due to the ignorance or recklessness of the men, who should have switched off at the gate-end box and moved the trailing cable out of harm's way before withdrawing the iron sheet.

11. *Risehow Colliery, Cumberland.* October 29th.—Deceased, employed as a "trailer," was endeavouring, with the assistance of another, to replace a derailed full tub, and took hold of a trailing cable that was suspended by the side of the road. The insulation of the cable was defective, and he received a severe shock. The system was 3-phase at 500-550 V, the neutral point being free.

12. *Milfraen Pit, Monmouth.* November 27th.—Deceased, employed as a pump attendant, was found unconscious with one hand on the control switch of the pump motor and the other on the covering of the outgoing cable, as if he had been about to start or stop the pump. It transpired that the electrical staff had recently been at work upon this pump motor and had removed the slip ring control and had substituted direct switching of the stator circuit on to the line. The system was 3-phase at 500 V, the neutral point being insulated.

13. *Black Boy Mine, Durham.* December 3rd.—Two linesmen were set to work changing connections on the top of a 35-ft. "H"-type timber pole which carried two sets of 3-phase high-pressure lines. The insulators carrying the bare conductors comprising these lines were attached to three lengths of channel iron bolted horizontally to the two wooden poles. The linesmen had been cautioned and knew that these conductors were "alive," but one of them, while changing his position on the pole, attempted to pass between the line he was working upon and the live conductors, by way of the channel iron girders. It appears that he slipped and fell upon, or took hold of, one of the live conductors.

14. *Tudhoe Colliery, Durham.* December 18th.—Deceased was employed as a pump attendant below ground, and he appears to have opened the locked door of a high-pressure electric switch of the cubicle type in order to point out to a lad the live bus-bars at the top of the switch where mice used to be found dead prior to the fitting of a covering plate. Unfortunately, inserting a flame safety lamp which he took from the boy the better to illuminate the place, he touched a terminal at a pressure of some 1,600 V above earth. The system was 3-phase at 2,750-3,000 V, the neutral point being earthed.

Non-fatal Electrical Accidents and Dangerous Occurrences.

During the year, 47 notices were received of non-fatal electrical accidents at the time of their occurrence and 10 further notices were received later, making a total of 57 accidents of this class. Thirty-seven of these accidents occurred below ground and 19 above ground at mines under the Coal Mines Acts and one on the surface works at a quarry. In 53 instances some personal injury was caused affecting in all 57 persons.

Included in these totals are two cases of fire below ground due to electrical causes, and three instances of explosions of switchgear, one upon the surface and two below ground. It should be observed that outbreaks of fire above ground are not included unless personal injury directly results therefrom, and that explosions of switchgear are not compulsorily reportable as such.

One case of fire underground, that at Dodworth Colliery on November 23rd, was attributed to the insulation of one of the unarmoured direct-current cables becoming defective at the point where it touched the armouring of the 3-phase cable near the shaft bottom; arcing brought about a fault in the 3-phase armoured cable which caused the 3-phase circuit-breaker to trip. The failure of insulation on one pole of the direct-current system increased the stress on the insulation of the other pole with the result that the insulation of the unarmoured cables broke down and originated the fire.

Of the fires above ground, the destruction of the generating station at Ferndale on May 29th, is of interest, it being attributed to a defect in a large oil-cooled transformer

Maintenance of Electrical Equipment.

That there is room for improvement on this score must be admitted. There would be less difficulty in meeting the demand if all mine owners and managers realised, to quote from the preface of a recently-published text-book on colliery electrical engineering, "that the electrical engineer has developed from a mere workman into a man upon whose knowledge of his work and conscientious execution of his duties they must depend to a greater and greater extent for maintaining and increasing the output of coal under economical conditions." Systematic thorough examination and testing, with a convenient record and ready comparison of the results together form a necessary part of organised maintenance, and it is in this respect that many collieries, especially amongst the smaller ones, are deficient.

Revision of Official Memorandum on Electricity Regulations.

When the Electricity Regulations which were made under the Coal Mines Act, 1911, were established in 1913, a Memorandum was prepared by the Departmental Committee concerned, and was issued in the early part of 1914 to explain some of the practical points arising thereon. That publication served a necessary and useful purpose, both educative and administrative, but in 1920, when the Electricity Regulations applicable above ground came into force, it was decided that the time had come to enlarge the scope and revise the text of the memorandum. The original was therefore withdrawn and the new issue substituted in April, 1921. Certain paragraphs in that issue touching the matter of open sparking, or, as it is called to-day, flame-proof enclosure, opened new horizons and gave rise to considerable discussion, especially as to the degree of responsibility for suitability of design that could reasonably be assumed by the manufacturer. In the result, attention was usefully directed to the problems of flame-proof design, and the British Engineering Standards Association proceeded with the preparation of specifications for electrical apparatus with flame-proof enclosure. Arising therefrom, the British Electrical and Allied Industries Research Association explored the ground, and an investigation was undertaken at Sheffield University under the direction of Dr. R. V. Wheeler to determine or verify the factors governing the propagation of flame within closed and partially closed vessels, so that sure means of rendering them safe for use in coal mines might be devised. The results of the research into the problem of flange protection then undertaken have been published by the Safety in Mines Research Board, as Paper No. 5, by I. C. F. Statham and R. V. Wheeler.

Plug Connections for Trailing Cables.

In his report last year the Inspector referred to the preparation of a standard specification for plugs and sockets for mining use by the British Engineering Standards Association. That specification has not yet been issued, the delay being due to the difficulty of meeting all requirements as to space limitations, but such progress has been made that he hopes to be able to report publication next year. Although the primary object of that particular specification was to secure interchangeability, advantage was taken of the opportunity thus afforded to improve the design, in the direction of greater reliability, of the contact device which is intended to secure the continuity of the earthing circuit between plug and socket. That a radical improvement in this respect was desirable and indeed long overdue must have been obvious to anyone who had opportunities of seeing the condition of unreliability to which this earthing contact is frequently reduced, in the case of many existing designs, under working conditions. There have been a number of accidents due to the unreliability of the existing type of earthing contact, and the Inspector has, in the course of his routine inspections, come across many similar instances which, fortuitously, did not result in an accident. Systematic testing of the conductivity of these earthing devices would doubtless have disclosed the weakness of design and should have resulted in improvements both in design and in maintenance. Such testing, however, has been the exception rather than the rule. Defects in the earthing circuit do not interrupt the working of the plant and do not result in an accident unless there is also a failure of insulation, so that the testing of the earthing system is too often neglected for work that is more obviously pressing.

Automatic Protection of Circuits.

Although it is still probably true that in the majority of mines overload protection alone is used, that is to say, fuses or their equivalent in circuit-breakers are relied upon as the means provided to cut off all pressure automatically from the circuit affected by a fault, yet it is encouraging to note that in an increasing number of installations it is now recognised that something more is required to reduce the danger from fire consequent upon a failure of insulation in a cable or apparatus. Fuses are inherently incapable of preventing a sustained overload unless the setting is so close to the normal current as to result in tiresome and unnecessary interruption of service. Overload trip coils in circuit-breakers are preferable because the setting is more accurate and is less open to unauthorised interference, but without the addition of controllable time-lags so as to permit of close setting, overload trips are but little better than fuses for the prevention of fire due to an electrical breakdown. The solution of this problem will probably be found in the addition of leakage-protection, implying means to ensure the automatic isolation of a faulty circuit immediately the current leaks or flows in an abnormal path. Colliery engineers are now more generally adopting leakage-protection, usually in the form of core-balance with current transformers, for 3-phase systems, and it is interesting to observe that in several direct-current installations the Couse-Rosebourn system of discriminative leakage protection has been adopted with satisfactory results.

Coal-Cutting Machines.

According to the annual returns, over 30 million tons of coal were got last year by electrical coal-cutting machines, and there were in use at the end of the year 3,046 electrical coal-cutting machines of the bar, chain, and disc types, with a few rotary drills. The relatively large number of accidents that are noticed elsewhere in the report as having occurred in connection with trailing cables and plugs is in some measure an indication of the need for improvement in existing designs of plug connector. If comparison is made between the number of machines driven respectively by electricity and compressed air, but excluding from the latter the percussive machines, it will be seen that the number of electrical machines, which was 66.3 per cent. of the reduced total in 1915, represented 68.8 per cent. in 1924. Referring to the total numbers of machines of all types, while bar machines have increased 67¼ per cent., chain machines have increased nearly six times, and percussive drills, with a few rotary heading machines, rather more than two and a-half times in number.

Metalliferous Mines and Quarries.

The history of electricity in these mines is uneventful, and there have been very few reported accidents. The chief users of electric power are tin mines in Cornwall, followed, as to the horse-power of motors installed, by the iron-ore mines of Cumberland and the slate mines of North Wales.

There are no data available as to the use of electricity at quarries, but there are some considerable installations at work, in particular those of the Buxton lime firms in Derbyshire. The Inspector also visited installations of some importance in connection with the Welsh granite quarries and the whinstone quarries in Ayrshire.

Conditions in the Netherlands.

Electric Lamp Works Prosperous.

MR. R. V. LAMING, O.B.E., the British Commercial Secretary at The Hague, has forwarded to the Department of Overseas Trade a report,* dated February, 1925, on the economic, financial, and industrial conditions of the Netherlands. It is stated at the beginning of the report that the worst of the effects of the war have been got over, and the general situation, if not brilliant, is steadily improving, although slight relapses are sometimes felt in particular trades. The public financial situation is better than it has been for the last few years and the currency has steadily improved. About 133 million florins of fresh capital was issued during 1924. It is stated that there was a general disinclination on the part of the public to participate in purely industrial concerns without a wide margin of security, and in consequence higher premiums became necessary. Nevertheless, among the principal private issues was that of the Philips Incandescent Lamp Co. of ordinary shares of 3½ million florins at 150, and preference shares for 1,113,000 florins at 110. The incandescent electric lamp works reported a prosperous period, and at the end of the year they entered into a European combine.

Foreign Trade.

While actual figures of the electrical exports of the Netherlands during 1924 are not given, the report says that there was a larger demand for dynamos, transformers, &c., the principal

*Stationery Office, 2s. 6d. net.

markets being Belgium and the Dutch East Indies, the latter also taking increased supplies of steam boilers, steam engines, and turbines. Machinery generally was exported in slightly larger quantities, chiefly to Germany and the Dutch East Indies. More details are given with regard to electric lamp exports. A lowering of prices is apparent from the fact that, while the quantities were increased, the value was lower. The figures were as follows:—1924: 5,013 metric tons, valued at 25,076,000 guilders; 1923: 4,678 tons (25,816,000 guilders). The principal consumers were France, Russia, Italy, and Australia.

Turning to the imports of electrical goods, it is seen that Germany remained the principal supplier of motors, machinery and apparatus, although supplies from this source were reduced during the year under review. The value of boilers imported increased by 1.1 million fl., Great Britain being second only to Germany in importance. Larger quantities of German steam engines and turbines were imported. The importation of internal-combustion engines increased by 1,500 tons and the value by 3.5 million fl., the greatest quantity coming from Germany and the greatest value from England. Imports of compressors, ventilators, pumps, cranes, &c., also increased. The imports of insulated copper wire were practically entirely German, and the same applied to lamps and lighting fittings. The number of electric vehicles imported showed an increase, and it is worthy of note that Hungary was the principal supplier with 27, as compared with 18 from Germany.

Railways, Tramways, and Telephones.

The electrification of the railway between Leiden and The Hague has been completed, but it has recently been stated that electric traction on this section will not be put into operation for passenger and other traffic until the whole line electrified. A number of steam tramways have been converted electrified. A number of steam tramways have been converted to electric traction and others are said to be following. In the meantime, in order to compete with motor omnibuses and lorries, petrol-driven tramcars are being used on some systems. The railways and tramways have lost a certain amount of traffic to motor transport, but, although a reduction of tariffs again increased the traffic, no increase of revenue resulted. A Royal Commission on transport systems has reported that although at present motor omnibuses may be competing with, they will finally prove to be useful feeders for railways and tramways, and it has suggested legislation conducive to this end.

With the exception of Amsterdam, Rotterdam, The Hague, Arnhem, Maastricht and Enschede, the telephone system is in the hands of the postal authorities. According to the latest available figures, on January 1st, 1923, the number of instruments in use numbered 185,122, or 2.6 per 100 inhabitants, and the length of the lines to 600,000 km. or 8.5 km. per 100 inhabitants. The submarine telephone cable between England and Holland was duplicated during the year owing to the pressure of traffic. The new cable is of greater capacity and is also intended for international calls between England and Germany.

General.

At the end of 1924 a Revised Customs Duties Act became law. The original Act was introduced in 1862, but under modern conditions of trade many difficulties were experienced in working the tariff, and a complete revision in respect of technical classifications and definitions had become necessary. Speaking broadly, the general effect of the new tariff is to increase the import duty from 5 to 8 per cent. *ad valorem*.

As regards British trade, the most obvious fact is that the quality of British goods is still recognised, but prices in many cases are too high. At one time when deliveries from other countries were bad the British supplier scored, but when improvements in deliveries set in considerations of prices again weighed heaviest. Any diminution in the quality of British products would counteract the slight advantage which they hold owing to their good reputation.

Exports and Imports of Electrical Goods and Machinery in July, 1925.

THE Board of Trade returns for July show that there was little change from the previous month in electrical exports and imports, so far as the totals were concerned, although there were large fluctuations among the items. The export total was slightly higher and the rises and falls in the items were about balanced. Submarine telegraph and telephone cable again showed a big change, exports being trebled, while the largest rise in value occurred in the case of telegraph and telephone instruments and apparatus. A large proportional increase is apparent in the figure for railway and tramway motors, and "other motors and generators" also experienced a notable rise. The greatest fall was one of about 25 per cent. in the case of unenumerated electrical machinery, which more than counterbalanced the rises in the other three items of the machinery section. There were also serious decreases in the exports of batteries and accumulators, meters and instruments, carbons, telegraph and telephone wires and cables (not submarine), and insulated wires and cables. A comparison with the statistics for July, 1924, reveals much the same position as the comparison with June, 1925.

There were also a number of violent fluctuations in the import list, an outstanding example being insulated wires and cables, the imports of which were halved in value. Other notable decreases occurred in telegraph and telephone wires and cables (not submarine) and glow lamps. A number of important increases also occurred, particularly in the case of batteries and accumulators, which reached about twice the value recorded in June. An even larger proportional increase is shown against the item meters and instruments, and the unenumerated machinery and goods both reached enhanced values. The rise in the total as compared with July, 1924, is of important dimensions, and attention may be drawn to the large advance in the case of glow lamps.

The increase of £8,183 in the re-export total was mainly due to the greater values recorded for telegraph and telephone instruments, and unenumerated goods and apparatus.

The gradual augmentation of all three sections is shown in the seven-month figures which appear at the bottom of the table.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for July, 1925.	Inc. or dec. as compared with June, 1925.	Inc. or dec. as compared with July, 1924.	Electrical imports for July, 1925.	Inc. or dec. as compared with June, 1925.	Inc. or dec. as compared with July, 1924.	Electrical re-exports for July, 1925.	Inc. or dec. as compared with June, 1925.	Inc. or dec. as compared with July, 1924.
Electrical goods and apparatus (unenumerated)	£158,474	+ £15,689	− £12,601	£89,469	+ £10,122	+ £10,077	£6,757	+ £2,684	+ £1,847
Insulated wires and cables ...	200,764	− 36,602	− 7,171	83,066	− 32,755	− 35,1	1,58	− 1,888	+ 1,581
Glow lamps	38,171	+ 12,719	13,644	39,445	− 9,947	+ 26,696	130	− 322	+ 54
Arc lamps and parts	298	− 4	− 263	279	− 531	− 802	5	− 23	− 70
Batteries and accumulators ...	87,775	− 20,085	+ 33,308	46,056	+ 23,368	+ 28,417	1,877	+ 294	+ 1,796
Meters and instruments ...	20,268	− 9,318	− 21,107	28,935	+ 18,056	+ 15,819	898	+ 686	− 924
Carbons	900	− 1,011	− 966	6,520	− 7	− 4,350	120	− 64	− 154
Electrical Machinery—									
Electrical machinery (unenumerated)	198,681	− 66,207	− 38,768	83,401	+ 13,128	+ 3,404	4,886	+ 66	− 4,066
Railway and tramway motors	53,864	+ 35,997	+ 2,229	—	—	—	—	—	—
Other motors and generators ...	181,254	+ 26,058	− 6,204	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	815	+ 1,138	+ 2,443	160	+ 99	+ 148	187	+ 187	+ 185
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	41,249	− 14,697	− 36,876	11,697	− 4,213	+ 3,024	318	− 149	+ 275
Submarine telegraph and telephone cable	49,647	+ 33,725	+ 31,617	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	258,291	+ 37,226	+ 72,602	35,460	− 3,837	− 8,834	10,912	+ 6,212	+ 7,150
Totals	£1,299,751	+ £14,578	+ £31,888	£384,488	+ £13,481	+ £72,741	£27,671	+ £8,183	+ £7,674
Increases for the seven months ended July, 1925		Exports. £1,949,664			Imports. £739,712			Re-exports. £43,163	

The Automatic Disposal of Boiler-House Ash.

The Blackburn Meadows, Sheffield, Aerial Ropeway.

THE aerial ropeway that was installed for the automatic disposal of the ashes from the boiler house of the Sheffield Corporation's Neepsend electricity generating station was described in our issue of April 9th, 1915. We are now able to illustrate a much more ambitious ropeway scheme, designed for the removal of the ashes from the Blackburn Meadows station.

In this case Mr. S. E. Fedden, chief electrical engineer and general manager of the Sheffield Corporation electricity undertaking, was faced with the difficulty of the disposal of the ash

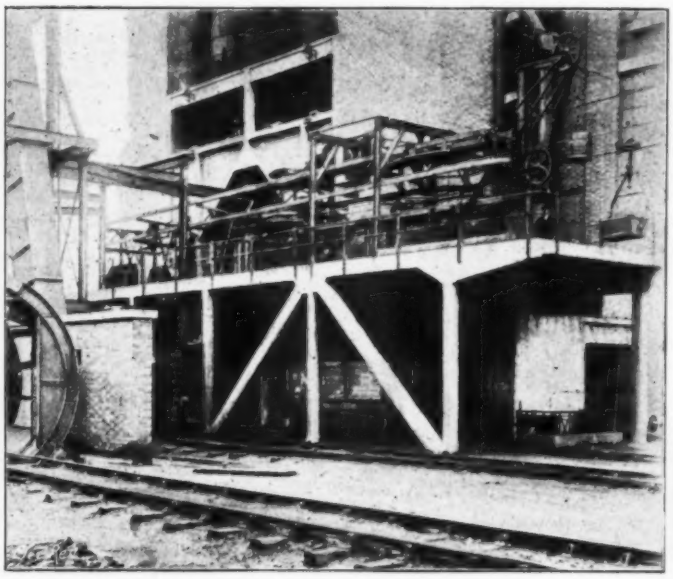


Fig. 1.—Side View of Loading, Driving, and Tension Terminal.

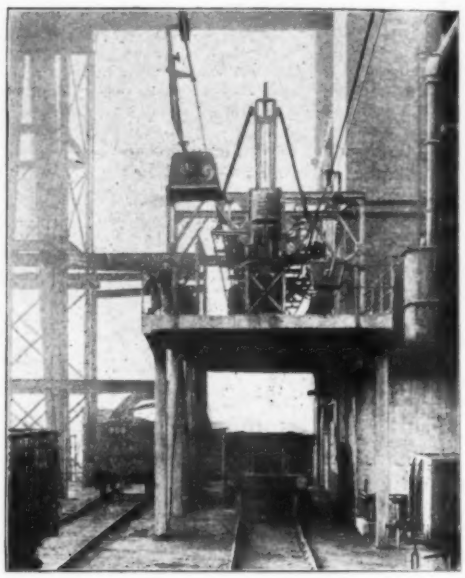


Fig .2—End. View of Terminal.

owing to the fact that there was no dumping room available in the immediate vicinity of the power station itself. The most convenient place was at a point about 3,000 ft. away, where a large valley offered a suitable dumping ground, but to get to this point it was necessary to cross the main line of the L.M. and S. Railway and also two highways; also in order to provide ample tipping accommodation, so as to eventually fill up the whole valley, it was found necessary to run the ropeway in a kind of circular tour at the discharging end, so as to

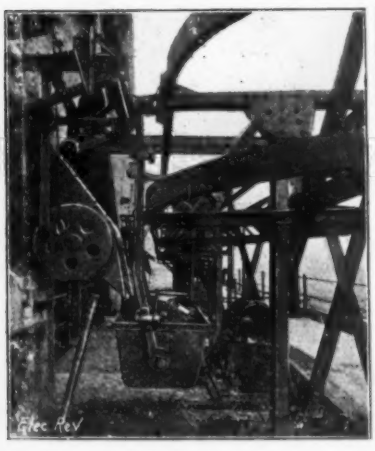


Fig. 3.—Carrier Box and Loading Shoot.

Fig. 4.—Automatic Angle Station.

envelop an area of about 12 acres, the whole of which would be available for tipping, giving a dumping capacity of approximately 30,000,000 cu. ft.

An aerial ropeway seemed to be the only possible form of conveyor that would meet the situation, and eventually the contract was again placed with Messrs. R. White & Sons, of Widnes. This ropeway is 7,127 ft. long overall and the capacity of the plant is 20 tons per hour in 5-cwt. net loads, with a dispatch of 80 loads per hour, or one load every three-quarter minute. The average gradient against the load is 1 in 12.8, whilst the steepest gradient against the load is 1 in 4.

There are a number of angle stations along the line and the whole of them are specially designed for absolute automatic working, so that the carriers, whether loaded or empty, will pass through them both on the concave and convex sides without being released from the hauling rope, stopped, or handled in any way. This, of course, is of great importance, as it would have added very materially to the cost of the working of the plant if it had been necessary to have a man in attendance at each of the five angle stations. As it is, one man at the loading station is all that is required for the ordinary working of the ropeway, for by means of Messrs. White's special system the incoming empty carriers, after being automatically released from the hauling rope on entering the loading terminal, are run by gravity along the inclined fixed loading rail up to any particular loading point as required, where each empty carrier is stopped automatically by means of special buffer gear in the right position for loading. In the present case the ashes and clinker are conveyed from the furnaces on the boiler-house floor by means of suction plant into two overhead loading hoppers of about 1,730 cu. ft. total capacity, with two loading shoots and valves of Messrs. White's special construction. In addition an electric hoist takes tip wagons loaded with ashes and clinker from the boiler-house floor and automatically tips their contents into the overhead loading hopper.

After the man in charge has filled the ropeway carrier box with ashes by gravity from the overhead loading bunker referred to above, simply by pulling a lever that operates the loading valve, he pulls another lever in order to release the buffer gear, when the loaded carrier is free to travel onwards along the inclined loading rail up to the outgoing end of the terminal, where it is automatically connected to the hauling rope and starts on its forward journey to the tipping ground. Each loaded carrier is also tipped automatically at any required point by means of a device which is made of a portable nature and can be moved to any point along the carrying rope where it is desired to discharge the loaded carrier boxes on the tipping section of the ropeway. This tipping gear is entirely self-contained, and does not require any guy ropes to keep it in position.

It will be realised that a large saving is effected by such a plant in the cost of labour and attendance generally.

The carriers have all been fitted with an improved type of automatic gravity rope gripper, with a positive friction locking device which ensures a safe grip on the hauling rope when the carriers are going up steep gradients, passing automatic horizontal angle stations, and also when passing

over sharp vertical angle stations at the intermediate towers. The carrier sheaves, the hauling rope supporting rollers on the intermediate standards, and the rope sheaves at the automatic angle stations, are all fitted with ball bearings, whilst lock-coil carrying ropes are used in order to reduce the working friction and give specially smooth and easy running.

At the loading and driving station a 27-b.h.p. patent 2-speed cascade induction electric motor has been installed, running normally at 720 r.p.m. with a hauling rope speed of 200 ft. per minute under ordinary working conditions but this speed can be reduced to 480 r.p.m. with a hauling rope speed of 133 ft. per minute when required occasionally for inspection purposes. On the main horizontal shaft of the driving gear an automatic brake arrangement is fitted, so arranged that immediately the ropeway is stopped the brake will come into action automatically, in order to prevent the ropeway running backwards in the case of loaded carriers being left on the upgoing side, with only empty carrier boxes on the return side.

Referring to the illustrations, fig. 1 is a general side view of the loading, driving, and tension terminal, built on the top of a reinforced concrete staging in order to give the necessary clearance above the railway. Fig. 2 is an end view of the same terminal with a loaded bucket just leaving the loading station, and an empty bucket returning on the incoming side; this view also shows the live weight arrangement provided to keep a constant tension on the hauling rope. Fig. 3 shows a carrier and box just after being loaded by gravity from the shoot valve, and also the buffer gear for stopping each carrier in the exact position required for loading. In this connection it may be mentioned that special trap doors have been provided at the top of the ferro-concrete staging, with one end hinged, so that as the trap doors are lifted up the free end will fit up against the lip of each fixed loading shoot to form a continuous shoot right to the openings in the top of the platform, in order that whenever necessary, ashes may be loaded directly into railway wagons standing below.

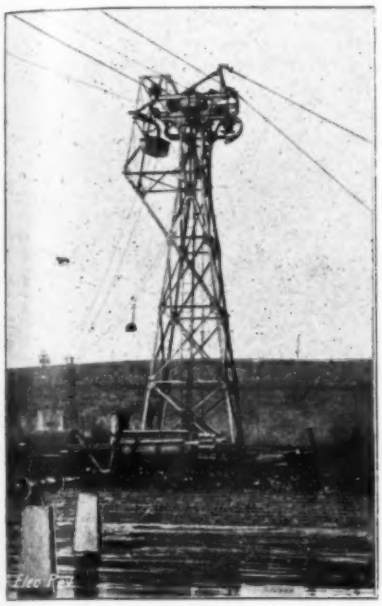


Fig. 5.—Automatic Angle Station.

Figs. 6 and 7.—Tipping Ground Angle Stations.

Fig. 4 illustrates the first automatic angle station from the loading terminal; it is self-contained in order to span the railway line without any guy ropes being required; it has an angle of 114 deg. and is 30 ft. high from the railway level.

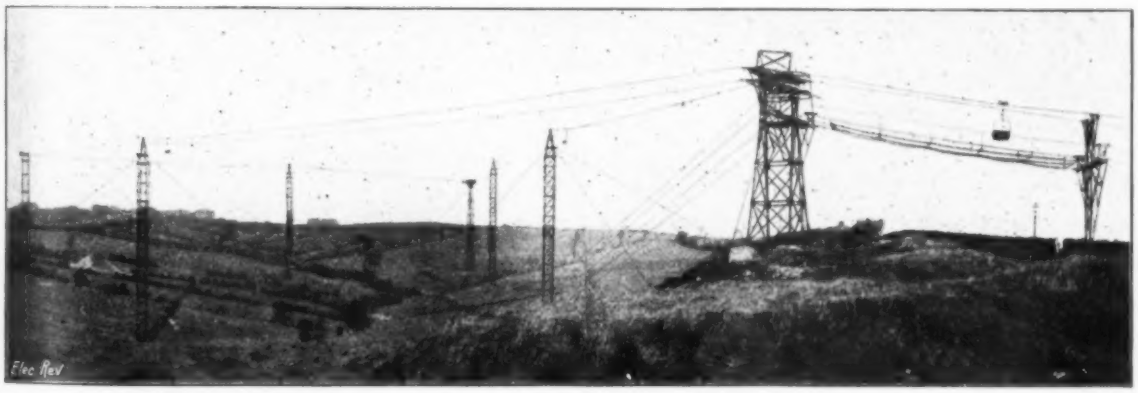


Fig. 8.—Triangular Tipping Section and Roadway Protective Netting.

Fig. 5 shows another automatic angle station, 40 ft. high, with an angle of 146 deg.

Fig. 9 is a side view of the protective bridge across the main line of the L.M. & S. Railway, with a clear span of 181 ft. 6 in. between the centres of the piers at each end. The bridge is made of steel with a wood platform and tongued and grooved boarding each side, the clear width of the bridge being 16 ft.

Fig. 9.—Protective Railway Bridge.

The two end piers are built up of bricks and are massive with heavy coping stones at the top, on which the ends of the bridge rest; the brick pier on the lower side of the railway is 59 ft. high whilst the one on the top side is 52 ft. high, measured from the top of the concrete foundations at the base. The clearance from the rail level to the underside of the bridge is about 45 ft. in the centre.

The protective netting across the new road to Rotherham has a span of 116 ft. with 20 ft. headroom from the road to the underside of the netting. The net itself is 16 ft. wide, with side nets 2 ft. 6 in. deep, reinforced with supporting wire ropes and cross spreader bars. The netting across Meadow Hall Lane has a span of 60 ft., with 20 ft. headroom, the net being 16 ft. wide with side nets. Fig. 8 is a general view of the triangular tipping section of the ropeway, and it also shows the protective netting over Meadow Hall Lane, together with the automatic angle station at the commencement of the tipping ground, which is 35 ft. high and has a divergent double angle, one of 119 deg. and the other of 155 deg., in order that each ropeway line may branch out in a different direction so as to meet the two further automatic angle stations shown on this figure on the tipping ground. One of them is indicated at the extreme right-hand side of fig. 8 and is 100 ft. high with an agle of 86½ deg.; the other can be seen in the far corner about the centre of fig. 8, just beyond the two main supporting standards indicated; it is 105 ft. high with an angle of 57 deg. As will be seen from the illustration, the tipping section of the ropeway is of a triangular form with a valley in the centre, and the ordinary supporting standards of square construction shown vary in height from 100 to 120 ft. Fig. 6 is a near view of one of the automatic angle stations on the tipping ground, which also shows a carrier box in the act of automatically discharging its contents, while fig. 7 is a front view of the angle station.

We understand that although this ropeway has to work under very special and difficult conditions, owing to the number of horizontal, as well as vertical, angle stations involved it has given every satisfaction in actual working and is fully up to the duty for which it was designed.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A New Crystal Set.

The new "Cosmos" crystal receiving set to which METRO-VICK SUPPLIES, LTD., has drawn our attention has several distinctive features. Apart from its neat workmanship and appearance, the provision of an arrangement, to be seen on the left of fig. 1, for tapping off various amounts of the tuning inductance across the detector circuit is, we believe, unique and not only conduces to sensitivity, but also allows the user to vary the selectivity of the set. Fig. 1 indicates that the coils are concealed in the base of the receiver, while tuning is effected by a variable condenser. The set is fitted with terminals enabling either one or two pairs of head-telephones to be used, and two types of detector can be supplied: a dust-proof glass-covered cats'-whisker detector with split ball and socket adjustment for the contact arm, or a "permanent" detector, the former being fitted with a screw cap which allows for any type of crystal to be used. The set may be hung on the wall if required, and a loop is provided for this purpose; when not in use the telephone can be hung on the tuning knob, thus making a neat and compact arrangement. It is claimed that good results can be obtained with this set at a distance of 75 miles or more from the Daventry high-power station, and 15 miles and over from a main station. The B.B.C. coil covers a wave-length from about 300 to 650 metres, and the long-wave coil from about 1,200 to 3,000 metres, depending upon size and height of aerial.

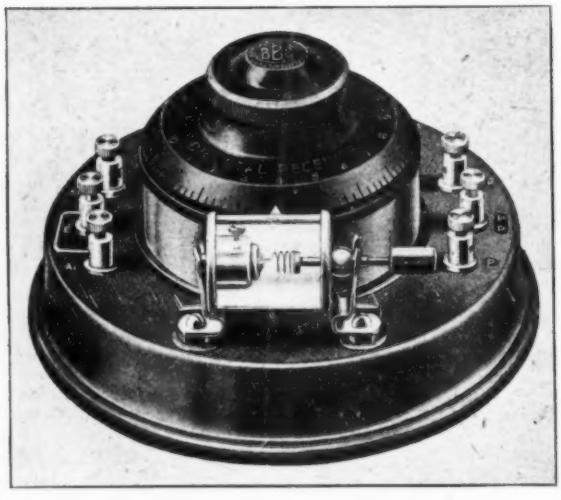


Fig. 1.—New Metro-Vick Receiver.

A Jacobean Cabinet Receiver.

A handsome product of the EDISON SWAN ELECTRIC CO., LTD., takes the form of a Jacobean cabinet radiophone loud-speaker set, which makes an excellent piece of furniture in oak with "old" brass fittings. Fig. 2 shows the arrangement as viewed from the front, the cabinet being 5 ft. high, 2 ft. 3 in. wide, and 1 ft. 7½ in. deep; the upper portion contains the receiver panel and wiring, while the lower portion is divided into three: First, there is an accessory drawer in which the tuning headphones may be kept; then there is a compartment to accommodate an Ediswan "Televox" loud-speaker that is adjusted by means of the usual modulator which is extended through the louvre front, which is shown in fig. 2. The loud-speaker leads are connected to the receiver by a plug and socket, an arrangement which enables the user to remove the loud-speaker for the purpose of extending the leads into an adjoining room. A recess is provided for a 6-volt filament accumulator in the loud-speaker compartment, below which is a cupboard to house the h.p. accumulator or dry batteries, as the case may be. The receiving circuit is of the dual type, embodying four valves and five stages: The first valve functions as both a high- and low-frequency amplifier; the second is the detector; and the third and fourth are both l.f. amplifiers, the last being resistance-capacity coupled. Capacity reaction is obtained by means of a variable condenser; the plate voltage of the l.f. valves is 120 V, and a fixed bias potential is applied to the grid of the first valves and a variable bias to the last two. Range "blocks" are provided with the instrument to cover wave-lengths of from 300 to 500 metres, additional blocks for longer waves being obtainable if required.

Fig. 2.—An Ediswan Cabinet Set.

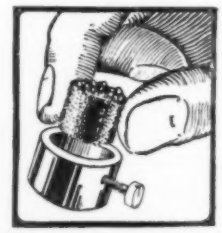


Fig. 3.—A "Round" Crystal.

Fig. 4.—An Ediswan Loading Coil

A "Round" Crystal.

The varying sizes and irregularity of form in which crystals are sold often necessitate the exercise of much patience when attempting to fit a crystal into its cup, but "standardisation" is the universal cry nowadays, and it is accordingly interesting to note that a crystal is now being manufactured in a regular cylindrical form adaptable to practically all crystal cups in common use. The new product, a sample of which we have received from TUNGSTALITE, LTD., is strong mechanically, and is, so far as we are aware, the only one of its kind that is made in a uniform size and shape. Fig. 3 indicates that it

will fit into ordinary-sized cups snugly without splintering; it is sensitive over its entire rounded, as well as over its cut surfaces, and each specimen has a useful surface equal to a total of three square centimetres.

A Plug-in Loading Coil.

We have received from the EDISON SWAN ELECTRIC CO., LTD., a sample WL 324 inductance coil of the plug-in pattern, which has been designed so that existing sets can be easily converted, by interposing the loading coil in the circuit, to receive broadcast from the new Daventry high-power station on a wavelength of 1,600 metres. The coil sent us, fig. 4, is rigid and well made; it performed its function without trouble.

Modified "Amplion" Construction.

What is said to be an improved method of assembling "Amplion" loud-speaker horns which are being fitted to their AR14, AR19, and AR22 models, is announced by Messrs. Alfred Graham & Co.; these models became available to the public on July 15th. It will be observed from fig. 5 that the flare is

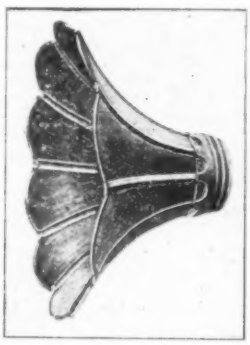


Fig. 5.—Modified "Amplion" Flare.

fitted with a threaded metal screw which is firmly held to the sound conduit by a heavy rubber bush; by this means assembly is quick and rigid. Also it will be noticed that the leaves of the horn are united by crystalline finished metal ribs and that they are similarly bound at the flare. The new method of constructing oak and mahogany horns is claimed to have proved advantageous, but it will not affect the price of the instruments.

The "Anvil" Coil Former.

Most amateur radio-telephonists prefer to construct everything they possibly can for their sets; they will find the "Anvil" coil former, one of which has been sent us by Messrs. BURWOOD CONCESSIONAIRES, LTD., a useful gadget that will satisfy their desire to wind coils cheaply. The ring is made of brass and is fitted with a neat wooden handle, the 30 pin holes being screwed; "Honeycomb," "Duolateral," and other patterns of coil may be wound on this former, which has been provisionally patented.

Short-Wave Radio-Telephone Communication.

Messrs. Autoveyors' New High-frequency Relay.

THAT the utilisation of short waves instead of waves several hundreds and thousands of metres in length to which we have been accustomed, will have a profound effect on the art of radio communication cannot be denied. Recent work with waves less than 100 metres in length has indicated clearly that conceptions and methods hitherto in vogue will have to be drastically revised, facts which Messrs. Autoveyors, Ltd., have not been slow to appreciate. Under the guidance of their technical director, Mr. A. E. Chapman, they have tackled the subject from a fresh point of view, and attempted to take into account factors which seem to have been somewhat neglected, if not overlooked, in the past.

They have announced that within the last few weeks they have successfully completed the design of several novel devices which together form what has been termed "compound focus" apparatus. This gear is intended to be employed as a means of short-wave radio-communication over long range, and the company has applied, we understand, to the secretary of the General Post Office in London, and to the district radio supervisor in New York, for a concession authorising it to initiate an ordinary commercial radio-telegraph service to handle traffic between this country and America. The company's main object in asking for such a concession was to prove, by demonstration and "practical working," its claim that it is able to establish and maintain efficiently with the aid of its new apparatus constant long-range communication with extremely low power.

The term "compound focus" is used to indicate that the radiations from the transmitter will be emitted in the form of a "ray"; that is to say, the focusing will be in both the vertical and horizontal planes, not in the latter only as in the Marconi "beam" system. In order to allow for the variation in the plane of polarisation of the electromagnetic waves radiated from the transmitter during the day, we understand the receiver is to be a simple oscillator pivoted about its centre and capable of being rotated in any direction, so that its position may be changed from time to time throughout the day.

While awaiting the necessary authority to enable it to substantiate its claims in this manner, the company has partially changed its policy in that it has decided to license thermionic valve manufacturers to produce and market one of the new components embodied in the "compound focus" apparatus, *viz.*, the high-frequency relay, and thereby, through the medium of the many successful dx. experimenters in this country, if possible, to secure evidence that radio communication between any two points in the British Empire may be effected and maintained at such a low cost as to establish the claim that a charge of 2d. or 3d. per word will present adequate recompense for the provision of such a service.

Several other entirely new components are embodied in the "compound focus" apparatus, which will be placed at the disposal of the public in due course, and one of the h.f. relay models that Messrs. Autoveyors propose to market will be suitable for broadcast reception on the B.B.C. wave band, it is claimed, in conjunction with suitable loading inductance.

The three electrodes of the new h.f. relay, of which we have samples, are assembled in a small glass cylinder which is provided with an ebonite cap at each end, the caps each having three terminals; the relays are robust and their overall dimensions are 1 in. diameter and 2½ in. in length. An unusual feature is that the relays are made positive and negative, one of each type being used in place of the common single-valve receiver. One of the several receiving circuits that may be used is reproduced in fig. 1, A and E being the aerial and earth, while the values of the coils used are marked on the diagram; B_1 and B_2 are the low- and high-pressure batteries respectively, the filament rheostats being marked R; the short straight tungsten filament F is surrounded by two concentric coils of thick wire (marked D) which are termed the "helix" and "rack" (*i.e.*, plate and grid), V+ and V− being joined as indicated in the diagram through two 0.00025 μF variable condensers C.

The filament voltage is from 1.8 to 2 V and its current 0.3 A; the helix voltage may be from 30 to 50 V, the emission at the lower voltage being stated to be 10 mA. When designing the h.f. relay an attempt was made to maintain magnetic symmetry, for it is maintained that the device functions electromagnetically in addition to electrostatically and that use has been made of phenomena differing considerably from those employed in the ordinary valve; the lengths of the arrows in the diagram are intended to represent, roughly, the augmented output that is obtainable by the use of the new component.

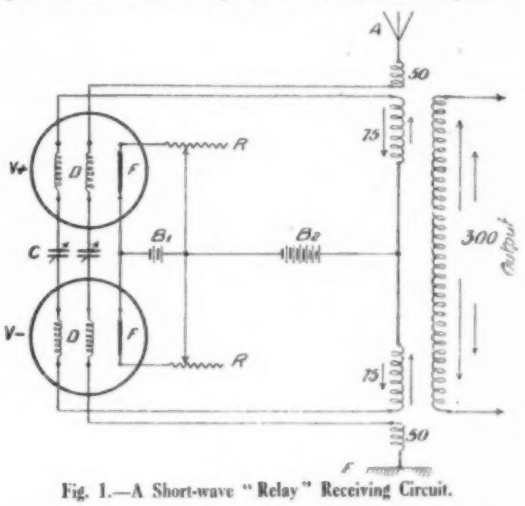


Fig. 1.—A Short-wave "Relay" Receiving Circuit.

It will be noted that in the positive relay the "helix" and "rack" are wound anti-clockwise, while in the other they are clockwise, and it is claimed that the high-frequency oscillating aerial currents which flow round the "racks" of the relays exercise an electromagnetic control on the filament emission and minimise interelectrode capacity, which is one of the chief difficulties encountered in short-wave work. Due to the reversal of the spirals in the negative relay, it is said that an increase of current in the positive relay is accompanied by a decrease in the negative one, and *vice versa*, so producing a push and pull action as indicated by the above-mentioned arrows.

Patents are pending, we understand, throughout the world, and in view of the somewhat bold claims of its inventor, it may perhaps be advisable to refrain from detailing and commenting upon the theoretical explanation of the action of the new "relay" until the specifications become available.

Reviews.

The Metallurgy of Aluminium and Aluminium Alloys. By ROBERT J. ANDERSON, B.Sc. Pp. xxxi+891. New York: Henry Carey Baird & Co., Inc. Price, 10 dollars net.

Since J. W. Richards's treatise of many years ago, little of a systematic nature has been published on aluminium from the metallurgical standpoint. The work under review enters in detail into the varied aspects of the metal and its alloys in industry, and the perusal of the volume impresses one with the advances which have taken place within recent years in this branch of metallurgical science. The whole volume bears the stamp of having been written by one who is not only fully conversant with the subject, but also possesses first-hand knowledge of the difficulties which beset the metallurgist of aluminium and its alloys.

The magnitude of the aluminium industry is shown by the fact that the world's production of the metal in 1923 amounted to 179,000 tons, 50 per cent. of which was consumed in the production of sheets, wire, and fabricated aluminium, the remainder being utilised in the manufacture of light aluminium alloys. In tonnage produced, aluminium now stands fourth among the non-ferrous metals, and it is exceeded only by copper, lead, and zinc. In nature aluminium is the most abundant of the industrial metals, being third in abundance of the elements in the earth's crusts, but in the commercial production of aluminium only two minerals are utilised, *viz.*, bauxite and cryolite; the process involves two stages, *viz.* (1) the preparation of alumina of high purity from bauxite, and (2) the electrolysis of the alumina produced in a liquid bath of cryolite and other added salts.

One of the chief difficulties in the metallurgy of aluminum lies in the fact that the metal, after being produced, cannot be refined as can copper and other of the common metals, and the purity of the metal secured by the electrolytic dissociation of alumina depends upon the purity both of the alumina and of the electrolytic bath; hence, it is necessary in the Hall and Héroult processes to use alumina as pure as possible. Aluminium electrolytic processes need essentially a source of cheap electrical energy, since an enormous amount of electricity is consumed, and all aluminium reduction plants in the world, with the exception of a few in Germany, consume energy derived from hydro-electric power plants. It is for this reason that aluminium reduction plants are normally situated within easy reach of waterfalls, steam-generated electric power being totally out of the question as a source of energy for economical aluminium production.

In view of the relative scarcity of bauxite the future growth of the aluminium industry, so far as greatly increased output of metal is concerned, depends upon two requisites, *viz.* (1) the discovery of new ores of aluminium, *i.e.*, ore that can be used as a basis for the production of aluminium by the processes at present employed; and (2) the development of methods for the treatment of ores that are not amenable to the Hall and Héroult processes, or similar reduction methods. A commercially feasible process for the production of aluminium from aluminium silicates and the common aluminium minerals is the desideratum at the present time, but while considerable experimental work has been done on this problem, no process other than the one covered by the Hall-Héroult patents is being employed to-day.

The book is divided into 19 chapters dealing with bauxite mining, the production, properties, and uses of aluminium and its alloys, melting practice, losses and defects in aluminium castings, mechanical and heat treatment, and the micrography and electroplating of aluminium. The author deals in considerable detail with the preparation of aluminium alloys, together with their rolling and other mechanical treatment. The soldering and welding of aluminium and aluminium alloys is discussed from the metallurgical standpoint. Aluminium parts can be soldered together, but not with any degree of permanence, due to the metals in the soldering alloy being electronegative to aluminium, and on contact with water, galvanic cells are set up so that the joint disintegrates by auto-corrosion. Autogenous welding by oxy-gas methods is employed extensively in the aluminium industry, for making joints of substantially pure aluminium and of aluminium alloys, and for making repairs and in salvaging castings.

An important part of the volume is the summarised statement of the aluminium productions of the various countries, markets, trade statistics and tariffs, which is remarkably comprehensive and of the greater value in that mere statistics are relieved by comments. A large amount of information is also given on the various patent aluminium alloys; this together with a most complete bibliography renders the compilation of special value.

The author being a practical metallurgist draws considerably from his own practical experience, and gives the manufacturer much valuable advice. Bearing in mind the extent and character of the literature to be dealt with, the author has been remarkably successful in bringing the subject matter up to date and compressing it into reasonable compass, and he has undoubtedly filled a hiatus in the list of books available for the technologist. The book has been edited with great care, is profusely illustrated, and is remarkably free from misprints.

A Text Book of Wireless Telegraphy and Telephony. By W. GREENWOOD, B.Sc.(Eng.), A.M.I.E.E., A.C.G.I. Pp. vii + 265; figs. 201. London: W. B. Clive, University Tutorial Press, Limited. Price, 5s. 6d. net.

In this book the subject is treated as a branch of electrical engineering, in much the same way as other branches of electrical technology are usually dealt with, and it is necessary therefore for the reader to be conversant with the fundamental principles of electricity. The author is careful, however, to avoid any advanced mathematical explanations in the body of the book, but includes at the end a chapter on "A few mathematical investigations," with proofs which the mathematical student is referred to in the appropriate places in the book.

This is a good arrangement, but we are in full agreement with Mr. Greenwood when he says "students of physics, whether pure or applied, cannot realise too early, that a knowledge of the rudiments of the differential and integral calculus and the methods of solution of the simpler differential equations is an essential part of their mental equipment."

The book covers the whole subject of the transmission and reception of wireless messages, the first third of the book dealing mainly with theoretical principles, and the remaining two-thirds with practical applications.

In a book of this sort, where the field is so extensive, the difficulty is to know how little can be said without omitting important matter, and the author has got over this difficulty very well by the avoidance of details combined with a profuse use of diagrams. The general arrangement, printing, diagrams and index are excellent, and add materially to the ease with which the subject can be studied.

The matter is well up to date, though indeed the allusions to the Imperial Wireless Chain on pages 126 and 140 might well have been omitted, as the scheme of high-power stations alluded to was abandoned a year ago. Some of the information given on important new arrangements such as that on "Metal Valves" and the "Beam System" is very short and sketchy, but it is impossible in the limits of space available to deal in more than outline with many aspects of the subject, even if they promise great development in the near future, and in such special cases the author is always careful to refer the reader to published papers where full details can be obtained.

This is a text book which can be especially recommended to electrical engineers, potential electrical engineers, and students of physics who wish to understand the principles, and the up-to-date practice, of wireless telegraphy and telephony.

Electricity and the Structure of Matter. By L. SOUTHERNS, M.A., B.Sc. Pp. iv + 128; figs. 34. London: Oxford University Press, Humphrey Milford. Price, 2s. 6d. net.

The non-scientific person cannot complain of any lack of willingness on the part of physicists to interpret for him the advance of modern theories of the constitution of matter. In the volume before us, Mr. Southerns has attempted to cover a good deal of ground in a small compass, and in spite of the fact that literary excellence is sometimes sacrificed for easy colloquialism, the book is thoroughly readable, and should assist the non-technical reader to a general idea as to the trend of modern discoveries in molecular physics. The book commences with a historical sketch, followed by a chapter on the rudimentary principles of electricity and magnetism. The author then deals very ably with the subject of radioactivity and the structure of the atom. In this section we find a very good account of some of the brilliant experimental work that has been carried out by modern physicists. Electromagnetic waves are next considered, the treatment including an account of wireless telephony that is so brief that we cannot think there are many people at all interested in physical science who will derive much instruction from it. A short chapter on the structure of crystals concludes the book. There is a good index, and a glossary of technical terms.

Intending purchasers of this book, who are electrical engineers, should be warned that a considerable portion of it is devoted to descriptions of simple electrical apparatus that have no particular bearing on modern theories of the constitution of matter, and on general grounds we think that this matter might have been somewhat curtailed.

Memorandum on Electric Arc Welding. Second Edition. Issued by Factory Department, Home Office. Pp. 12. London: H.M. Stationery Office. Price, 3d. net.

Much practical information and many useful hints are contained in this little book, which should prove of value to operators of electric arc welding equipment. The information is chiefly on precautionary measures which should be taken to safeguard the operator.

The general principle of electric arc welding is dealt with in the introductory chapter. The merits, or otherwise, of both a.c. and d.c. currents are compared, and an outline of the regulations applying to the installation in each case is given.

Work entailing special risks, such as welding on stagings and boiler work, is dealt with at length. The concluding chapters deal with injurious effects to the operator, and precautionary measures, and a special chapter is given to the injurious effects of radiations.

Searchlights and Wireless for Motor Lifeboats.

The Equipment of a Cunard Motor Lifeboat.

THE Board of Trade Merchant Shipping (Life Saving Appliances) Rules of 1924, which came into operation on July 1st, 1925, stipulate that foreign-going passenger vessels above a certain size must be provided with one or two motor lifeboats fitted with approved searchlight and wireless-telegraph installations. For this purpose Messrs. Siemens Brothers & Co., Ltd., of Woolwich, have designed a special searchlight projector and a compact and efficient wireless installation. Both of these have been approved by the B.O.T. and brief descriptions of them will prove of interest.

The searchlight projector consists essentially of a sheet brass barrel fitted with an 8-in. glass "Mangin" type mirror reflector, and is carried by trunnions on a U-shaped support, which in turn is held by a vertical spindle in a tripod pedestal. A general view of the projector is shown in fig. 1.

Fig. 1.—A General View of the Searchlight Projector.

The lamp is of the metal filament gas-filled type and is carried in a lampholder, which in turn is fixed to a carriage fitted in the bottom of the projector barrel and provided with a traversing screw. By means of this screw the lamp can be moved into the focus of the mirror for obtaining the maximum range of reflection, or out of it in order to obtain dispersion of the beam when it is desired to illuminate a larger area nearer to the boat. A vertical adjustment is also provided for. Current is conveyed to the lamp by a flexible cab-tire covered cable.

Fig. 2 shows the wireless installation fitted to a motor lifeboat now being built for the Cunard Steamship Co., Ltd. The transmitter is of the quenched-spark type which, with the aerial tuning inductances, makes a very neat and compact piece of apparatus. The receiver is of the three-valve type, dull emitter valves being used; there is one high-frequency valve, one detector valve and one note magnifying valve; a crystal detector is also supplied for emergency working. By means of a suitable switching arrangement, reception may be obtained either on the h.f. and detector valves, on all three valves, or on the crystal only.

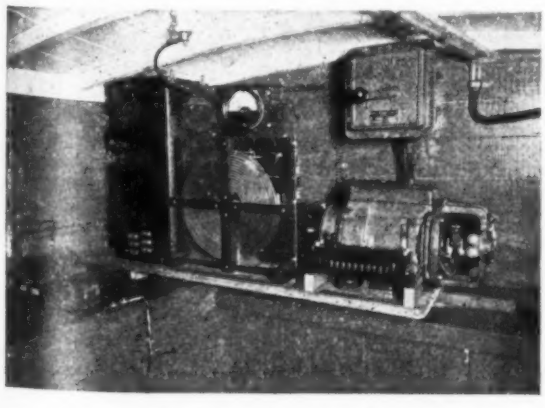


Fig. 2.—The Wireless Equipment on the Cunard Lifeboat.

The source of power for this installation is in the form of a battery of accumulators which supplies current to a small motor-generator, seen in fig. 2. An alternative source of power (which is supplied by the manufacturers, if preferred) consists of a petrol motor for driving the wireless alternator.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Charges for Electricity Supply.

I notice a letter from "Stung" in last week's REVIEW, which is rather involved.

The writer complains that he has to pay £2 per annum minimum charge for "juice" of which he only uses 12 units a quarter. If that is the actual load he finds for the supply people, he should pay one shilling per unit, and even then he is not a profitable customer to them. There are several pounds' worth of copper, meter, labour, &c., lying idle, or nearly so, and the best thing for him is to try "Trylites" and cut out electricity.

Next, he refers to his fixed charge as 11s. 8d. per quarter, and immediately afterwards says it is a standing charge of 19s. per quarter.

If "Stung" would cut out coal and gas, and use electricity properly, *i.e.*, for radiators and cooking, he should use at least 2,000 units per annum; his cost would then be 46s. 8d. fixed charge, plus 83s. 4d. for "juice," or a total cost of about ¾d. per unit. He can then cut out any question of cleanliness and convenience and come right down to brass tacks, because he is getting exceedingly good value for his money. In fact, he is buying energy at about cost price and at a price which will compare favourably with gas and coal.

I should like to know of neighbouring towns which sell energy cheaper than Manchester on the Norwich rate.

If "Stung" will *use* electricity, not play at it, he will find it the cheapest thing he ever bought. If he will compare a joint of meat cooked electrically and a similar joint cooked in a poisonous gas, he will find that he gets his electricity for nothing.

E. O. Walker.

Manchester, *August 24th*, 1925.

[The charge of 19s. per quarter was obviously, in round figures, the sum of the fixed charge of 11s. 8d. and the rent of the cooker, 7s. 6d.—EDS. ELEC. REV.]

Is There an Age Limit?

As the original query of the 10th ult. seems to have missed its mark, I venture to offer the following comments:—

To withhold one's true age is folly.

To believe that employers of labour would prefer a man of thirty against a man of forty-five provided each man has gathered equal knowledge day for day seems devoid of method in the madness. For Major Porter to cast back at us, who remained behind, that played-out theory that we were cowards shows truly weakness. Let's stick to age limits.

The difficulty seems to be that somehow or other many employers have got it into their heads that young bloods will succeed where knowledge and the hard knocks of time may fail.

In their over-anxiety to recover trade they forget that De Lesseps was 64 at the time of the building of the Suez Canal; Morse was 40 when he demonstrated the practicability of the telegraph; Stephenson was, I believe, 43, Herschel ditto, Volta 44, and many others could be cited.

Engineering is not imagination, the composition of poems or essays. It is time *v.* intellect plus possibilities. As one of 45 and out I shall not flinch from offering my past experience and fear no man of 30 if given a fair hearing. I know as a late advertiser that much of both answers to and advertisements of those 30 years old and under is false and misleading, as a careful perusal of advertisements and answers will show that the man who has been through the mill of 56 hours' work per week, plus three nights a week at evening technical classes, the rest of his spare time being spent in preparing his lessons, can easily be backed against the modern youth, to whom Sir John Foster Fraser has just appealed in his article, "A Talk to Workshy Youths."

It is not the masters that are to blame. But on the contrary, let us sink this influence, aim at investigation, cause and comparisons, remember that science is measurement. Then and then only will England and the world see, and know, that men of 40 years are not less worthy of engagement than the man of 30, nor short of intellect.

Let those of 40 be true to their colours, remember the war period and keep on trying: "It's for Britain and the British."

"All Ages Need Apply."

(*A reader of* ELEC. REV. *since* 1897.)

August 19th, 1925.

The Motor Repair Shop.

We have read with some interest the article on the above subject in your last issue, and the impression left on our minds is that your correspondent has succeeded in filling more than a column (exclusive of photographs) by describing two attempts at carrying out what is quite an ordinary and every-day repair. It is well known that carbonised mica leads to breakdowns, and that when the destruction of the mica segments has gone to such a depth as the author describes, the only remedy is to replace them.

We were surprised to read that an attempt was made to repair a job by filling in with cement to such a depth as half-an-inch. The result inevitably is the formation of air pockets, with obvious results. Such filling to a very small depth is quite permissible. It is the practice of most first-class repair shops to examine all armatures for shorted commutators before proceeding to any other repairs, and to replace all faulty micas. This can be done in most cases without taking the commutator adrift. Turning up or grinding a commutator with the armature in its own bearing has been considered good practice, where possible, for over a quarter of a century.

We entirely agree with the remarks about the grooving of bearing bushes (referred to as "brushes" in error in the text), and have found by experience that a very large percentage of breakdowns on d.c. armatures is due to commutator trouble arising from oil creepage.

The Midland Electric Power Installation Co.
(H. JOSEPH, *Proprietor.*)

Wolverhampton, *August 22nd*, 1925.

The Development of Short-wave Radio-communication.

In an article which appeared in your issue of July 31st, I notice the following remarkable statement:—

> "That attention has in recent times been redirected to short waves, *i.e.*, under 100 metres, is due to amateur experimenters having obtained surprising results over long distances with very small power, and the investigation of the new effects which have been recorded may influence future developments profoundly."

It appears to me that the writer of the article is not quite fair to other and earlier workers in stating that the attention which has been redirected to short waves is due to the work of amateurs, unless indeed he classifies myself, Mr. C. S. Franklin, and other engineers of the principal radiotelegraphic companies of the world as "amateurs."

As far back as June 20th, 1922, in a paper which I read in New York before a joint meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers, in describing the results which had shortly before been obtained by Mr. Franklin and myself with waves a few metres long, I stated that:—

> "The study of short electrical waves, although sadly neglected all through the history of wireless, is still likely to develop in many unexpected directions and open up new fields of profitable research,"

stating also in the same paper how:—

> "Some years ago, during the war, I could not help feeling that we had perhaps got into a rut by confining practically all our researches and tests to what I may term long waves or waves of some thousands of feet in length."

This paper was duly printed in the *Journal* of the A.I.E.E., and an extract from it appears in the issue of your REVIEW of August 25th, 1922.

In a paper read before the Royal Society of Arts on July 21st, 1924, I described a great number of tests carried out over world-wide distances by myself and my assistants with waves under 100 metres in length, and I particularly referred to the first radio communications ever established between England, Australia, and South America, by means of such short waves; and in a further address delivered before the same Society on December 11th, 1924, I described how, by means of a 32-metre wave, communication had been maintained with Australia for 23½ hours out of the 24.

Extensive reference to both these papers was made by the ELECTRICAL REVIEW in its issues of July 25th, 1924, and December 19th, 1924, and in one of your Editorial Notes of your issue of December 19th, 1924, you stated:—

> "Senatore Marconi took up the systematic study of short waves in 1916, and investigations were carried out on a large scale in 1920-21, but the most important experiments have taken place during the past twelvemonth."

I do not wish in any way to belittle the results obtained by amateurs in this and other countries, whose work of patient research I have always acknowledged, as I also stated in my last lecture before the Royal Society of Arts.

I might add, in conclusion, that all the contracts of over a year ago entered into with the Post Office for the erection of "beam" stations for Imperial Communications contemplated the use of short waves only.

G. Marconi.

London, *August 19th*, 1925.

Fire at Grenoble Exhibition.—According to a *Reuter* message from Grenoble, in the course of a storm on the evening of August 19th, lightning struck one of the buildings at the Hydro-Electric Exhibition. Fire broke out and completely destroyed the building, which contained aeroplanes, motor-cars, small electrical apparatus, &c. The damage is estimated at about ten million francs. The fire was extinguished at midnight. No other building was damaged. An inquiry has established that the lightning struck an electric transformer, set fire to an awning above the roof, and thus caused the flames to spread with extraordinary rapidity.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken

1924.

7,858. "Regulating means for electric circuits." J. Robinson. March 27th, 1924. (237,538.)

8,057. "Magnetos for internal-combustion engines." D. Y. Wheatley. March 29th, 1924. (237,634.)

8,493. "Reception apparatus for wireless telephony and the like." A. L. H. Capon. April 4th, 1924. (237,638.)

10,939. "Means for measuring the flow of electric current in a three-wire circuit." E. W. Moss (Lincoln Meter Co., Ltd.). May 3rd, 1924. (237,658.)

11,390. "Telephone instruments for wireless reception and other purposes." I. Raczincki. May 8th, 1924. (237,663.)

11,665. "System of electrical signalling and inter-communication between railway signalmen and engine drivers." H. Wallace, L. Wallace, J. H. Wallace, and D. McCall. May 12th, 1924. (237,664.)

11,734. "Recording of telegraphic signals transmitted over telephone lines." A. Engelberg. May 12th, 1924. (237,666.)

12,106. "Inductance coils for use in wireless telegraphy and telephony." W. S. Shephard. May 16th, 1924. (Cognate application, 13,022/24.) (237,672.)

12,392. "Variable electric condensers." Sterling Telephone & Electric Co., Ltd., and W. M. Holbeach. May 20th, 1924. (237,677.)

12,675. "Thermionic valves or electron discharge tubes." Mullard Radio Valve Co., Ltd., and S. R. Mullard. May 23rd, 1924. (237,680.)

12,819. "Electrode compositions for electron discharge devices." British Thomson-Houston Co., Ltd. July 2nd, 1923. (218,630.)

13,146. "Variable electrical resistance devices." G. W. Hale, L. H. T. Holden, and Radio Engineering Co., Ltd. May 28th, 1924. (237,683.)

14,079. "Electric cables." Dr. V. Planer. June 7th, 1923. (217,249.)

15,137. "Loud-speakers and electromagnetically-vibrated diaphragms." C. A. Vandervell. June 23rd, 1924. (237,690.)

15,956. "Switches for electrical circuits." Fuller's United Electric Works, Ltd., and A. P. Welch. July 2nd, 1924. (237,705.)

16,019. "Oil-immersed circuit breakers." English Electric Co., Ltd., and F. N. Linstow. July 3rd, 1924. (237,707.)

16,353. "Methods of securing and supporting tramway rails in position on roads." W. J. Hadfield. July 8th, 1924. (237,711.)

16,535. "Electric condensers." P. S. Devereux. July 10th, 1924. (237,714.)

17,067. "Electric tachometers." British Thomson-Houston Co., Ltd., A. P. Young, and J. Hutt. July 16th, 1924. (237,719.)

17,266. "Crystal detectors for wireless receiving apparatus and the like." H. Lister and Metropolitan-Vickers Electrical Co., Ltd. July 18th, 1924. (237,721.)

17,279. "Electrical heating apparatus." J. E. Dubois. July 18th, 1924. (237,722.)

17,846. "Swivelling head-lamps for motor road vehicles." J. M. McLean and S. Partridge. July 25th, 1924. (237,728.)

17,901. "Electron discharge devices, and circuit arrangements therefor." British Thomson-Houston Co., Ltd. July 27th, 1923. (Addition to 205,038.) (219,705.)

18,310. "Protection of rotary converters." English Electric Co., Ltd., and R. A. R. Bolton. July 31st, 1924. (237,730.)

18,611. "Electrical control systems." Metropolitan-Vickers Electrical Co., Ltd. August 6th, 1923. (220,309.)

18,738. "Electrical transformers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 10th, 1923. (220,314.)

19,628. "Apparatus for producing high-frequency currents for human cure." E. Geissler and Fabrik Chem. Gravuren Luppe & Heilbronner Ges. August 19th, 1924. (237,738.)

20,365. "Variable condensers for use in wireless systems." G. A. Mitchell. August 28th, 1924. (237,742.)

21,015. "Electric batteries." Soc. Anon. Le Carbone. July 12th, 1924. (236,884.)

21,301. "Systems of speed control for induction motors." British Thomson-Houston Co., Ltd. September 10th, 1923. (221,805.)

22,082. "Cut-out devices for groups of pneumatically-operated switches." G. Meyfarth and Soc. Anon. des Ateliers de Secheron. November 22nd, 1923. (225,180.)

22,924. "Self-driving electricity-generating plant." F. B. Dehn (P. W. Babbitt). September 29th, 1924. (237,759.)

23,092. "Remote-control systems for electrical sub-stations and other distribution systems." Metropolitan-Vickers Electrical Co., Ltd. October 1st, 1923. (222,864.)

24,371. "Variable electric condensers." A. G. St. Clair-Finlay and Pressland Electric Supplies, Ltd. October 14th, 1924. (237,763.)

27,158. "Telephone systems." Siemens & Halske Akt. Ges. November 13th, 1923. (224,908.)

28,881. "Heat-proof and flame-proof insulated conductor." Western Electric Co., Ltd. (Western Electric Co., Inc.). December 2nd, 1924. (237,786.)

29,424. "Rotary distributor or timer contact disk for ignition systems of internal-combustion engines." E. W. Turner. December 8th, 1924. (237,790.)

29,946. "Metallic compound strips." Metropolitan-Vickers Electrical Co. Ltd. January 8th, 1924. (227,424.)

29,987. "Crystal detectors for wireless receiving systems." G. Edmonds, Ltd., and H. Edmonds. November 12th, 1924. (Divided application on 26,982/24.) (237,793.)

30,786. "Diaphragms, telephones, and the like." G. Lakhovsky. December 22nd, 1924. (237,798.)

1925.

427. "Devices for obviating the glare of the headlights of motor-cars and other vehicles." F. W. J. Robinson. June 6th, 1925. (237,801.)

927. "Thermally operating electric relays." Metropolitan-Vickers Electric Co., Ltd. January 16th, 1924. (227,829.)

2,623. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). January 29th, 1925. (237,814.)

3,426. "Electric devices for piercing and cutting metals by fusion." Soudure Autogene Française. July 23rd, 1924. (237,552.)

3,450. "Telephone exchange systems." Allmanna Telefonaktiebolaget L. M. Ericsson. March 21st, 1924. (231,138.)

5,555. "Instruments for the measurement of electric resistance." Evershed & Vignoles, Ltd., and C. Midworth. February 28th, 1925. (237,823.)

5,876. "Audible warning devices." R. Bosch Akt. Ges. May 24th, 1924. (234,452.)

6,520. "Electric coil-holders." P. & C. Manufacturing Co., Ltd., and W. Posner. March 10th, 1925. (237,832.)

8,700. "Electrically-heated appliances." Metropolitan-Vickers Electrical Co., Ltd. April 8th, 1924. (232,305.)

10,181. "Manufacture of electric cables." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. April 18th, 1925. (237,839.)

13,437. "Receiving apparatus for wireless telegraphy and telephony." Aron Elektrizitats Ges. May 22nd, 1924. (234,511.)

16,850. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline (Automatic Electric Co., in part). April 24th, 1924. (Divided application on 10,196/24.) (237,852.)